

**RESEARCH AT TECHNIKONS:  
THE JOURNEY FROM APPRENTICESHIP  
TRAINING TO TECHNOLOGICAL DEGREES**

**ANNA WOUTERINA ERASMUS**

**Dissertation presented for the Degree of Doctor in  
Philosophy at the University of Stellenbosch**



**Promoter: JOHANN MOUTON**

**MARCH 2008**

I, the undersigned, hereby declare that the work contained in this thesis is my own original work and that I have not previously in its entirety or in part submitted it at any university for a degree

Signature

Date

Copyright © 2008  
University of Stellenbosch

All rights reserved

## **ABSTRACT**

This thesis presents the findings and conclusions of the function of research in the technikons' journey from apprenticeship training to technological degrees.

The analysis and interpretation of primary sources on the development of technical higher education and research revealed that research developments at technikons evolved in a pattern so closely resembling and reflecting an evolving technical education mission that it is difficult if not impossible to pinpoint cause and effect.

The evolving technical education mission was characterised by diversity entrenched in the provision of technical education, a continuing problematic process of differentiation between vocational and technical education, the development of formal centrally-controlled technical higher education and continuous differences between the Education Department and the sector officials on the nature of the technical higher qualifications and the role of research in these qualifications.

As a result of the factors characterising the development of technical higher education, gaps were created between the technikon officials' vision of research at technikons, the strategies and plans to establish a research culture and the technikons' research performance. In addition, an evaluation of technikon research performance in terms of the nature, scope, content and volume of research reflects a limited understanding of the relation between the input factors and the process factors utilised to lead to a system capable of sustaining a research culture, especially in view of maintaining the newly-assigned University status.

## OPSOMMING

Hierdie dissertasie handel oor die bevindinge en slotsom ten opsigte van die funksie van navorsing in die teknikons se reis van vakleerlingskapopleiding tot die aanbied van tegnologiese grade.

Die analise en interpretasie van primêre bronne wat handel oor die ontwikkeling van hoër tegniese onderwys en navorsing het bewys dat navorsingontwikkeling by teknikons op 'n manier ontwikkel het dat dit die evolusie van die tegniese onderwysmissie streng navolg en reflekteer. Dit maak dit moeilik, indien nie onmoontlik nie, om die oorsaak en gevolg vas te stel.

Die evolusie van die tegniese onderwysmissie is gekenmerk deur diversiteit wat ingebed is in die voorsiening van tegniese onderwys, 'n voortdurende problematiese proses van differensiasie tussen beroeps- en tegniese onderwys, die ontwikkeling van formele sentraalbeheerde hoër tegniese onderwys en voortdurende verskille tussen die Departement van Onderwys en die sektorbeamptes oor die aard van die hoër tegniese kwalifikasies en die rol van navorsing in hierdie kwalifikasies.

As gevolg van die faktore wat die ontwikkeling van hoër tegniese onderwys gespeel het, het gapings ontstaan tussen die teknikonbeamptes se visie van navorsing aan teknikons, die strategieë en planne wat ontwikkel is om 'n navorsingskultuur te vestig en die teknikons se navorsingsuitsette. Saam daarmee het 'n evaluasie van teknikonnavorsingprestasie in terme van die aard, omvang, inhoud en volume 'n beperkte begrip van die verhouding tussen insetfaktore en die prosesfaktore wat gebruik word om tot 'n sisteem te lei wat daartoe in staat is om 'n navorsingskultuur te onderhou, gereflekteer, veral met die doel om die nuuttoegekende universiteitstatus te onderhou.

## ACKNOWLEDGEMENTS

I would like to acknowledge the contribution of the following people and organisations towards this thesis:

1. Professor Johann Mouton, my promoter, for his guidance and wisdom at critical stages of the project.
2. Professor Wim van Averbek, for his continuous support and insight during the proposal stage of the project.
3. Professor Esther Hoffmann, who were patient with me when I learnt to do research.
4. Bryan, for sacrificing time which we could have spent together and who provided moral support throughout the project.
5. The Border Technikon, for the tuition fees paid towards the qualification.
6. The National Research Foundation, for the doctoral scholarship and Thuthuka grant.

SOLI DEO GLORIA

I would like to dedicate this thesis to two men who, each in their own way, provided me with a prominent remaining example:

Ek dra graag hierdie tesis op aan my pa:

**Andries Gustav Stephanus Gous**

And I also dedicate this thesis to my father in law:

**Carl Erasmus**

## LIST OF FIGURES AND TABLES

	PAGE
FIGURE 1: THE ESTABLISHMENT OF A RESEARCH CULTURE AT TECHNIKONS	200
FIGURE 2: A SYSTEMS FRAMEWORK OF THE RESEARCH CULTURE AT TECHNIKONS	206
FIGURE 3: TECHNIKON STAFF WITH POST-GRADUATE QUALIFICATIONS	208
FIGURE 4: GROWTH IN POST-GRADUATE ENROLLMENTS	211
FIGURE 5: ANNUAL DISTRIBUTION OF MASTER'S AND DOCTORAL AWARDS	218
FIGURE 6: GROWTH IN MASTERS AND DOCTORAL BURSARIES	221
FIGURE 7: DISTRIBUTION OF THRIP GRANTS	224
FIGURE 8: SYSTEMS FRAMEWORK INDICATING INPUT, PROCESS AND OUTPUT	267
TABLE 1: CLASSIFICATION OF TECHNICAL EDUCATION (Snape, 1912:13-18)	33
TABLE 2: QUANTITATIVE INSTITUTIONAL SIZE AND SHAPE FEATURES	112
TABLE 3: NWG MERGER RECOMMENDATIONS	125
TABLE 4: NEW HIGHER EDUCATION LANDSCAPE	134
TABLE 5: FRD STUDY FINDINGS	171
TABLE 6: PERMANENT TEACHING STAFF AT TECHNIKONS	207
TABLE 7: PROFILE OF POSTGRADUATE QUALIFICATIONS OF TECHNIKON STAFF	210
TABLE 8: M AND D ENROLLMENTS (HEAD COUNT)	211
TABLE 9: INCREASE IN MASTER'S AND DOCTORAL ENROLLMENTS	211
TABLE 10: M TECH ENROLLMENTS OF NHD AND B TECH GRADUATIONS	212

TABLE 11:	CESM CATEGORY BREAKDOWN OF M TECH ENROLLMENTS	214
TABLE 12:	1999/2000 NRF TECHNIKON GRANTS	215
TABLE 13:	2001/2002 NRF TECHNIKON GRANTS	216
TABLE 14:	MASTER'S AND DOCTORAL AWARDS	217
TABLE 15:	ANNUAL DISTRIBUTION OF MASTER'S AND DOCTORAL AWARDS	217
TABLE 16:	AVERAGE AMOUNT OF FUNDING PER STUDENT	218
TABLE 17:	NUMBER OF GRANTS IN COMPARISON WITH NUMBER OF STUDENTS	219
TABLE 18:	MASTER'S AND DOCTORAL BURSARIES	220
TABLE 19:	ANNUAL INCREASE IN MASTER'S AND DOCTORAL BURSARIES	221
TABLE 20:	INDUSTRY NRF/THRIP GRANTS	222
TABLE 21:	INDUSTRY NRF/THRIP PARTNERS	222
TABLE 22:	THRIP-FUNDED PROJECTS	223
TABLE 23:	CURRENT PROJECTS FROM 1984 TO 2002	227
TABLE 24:	CURRENT PROJECTS FROM 2000 TO 2002	229
TABLE 25:	CLASSIFICATION OF PROJECTS IN CESM CATEGORIES (1984 – 1998)	231
TABLE 26:	MASTER'S AND DOCTORAL ENROLLMENTS IN CESM CATEGORY 8	231
TABLE 27:	FRD ACTIVITY AREAS FOR 1997	234
TABLE 28:	FRD ACTIVITY AREAS FOR 1998	234
TABLE 29:	NRF ACTIVITY AREAS FOR 1999	235
TABLE 30:	NRF ACTIVITY AREAS FOR 2000	235
TABLE 31:	NRF ACTIVITY AREAS FOR 2001	236
TABLE 32:	CAPE TECHNIKON RESEARCH FOCUS AREAS 1988 – 1998	236



TABLE 33:	CAPE TECHNIKON FOCUS AREAS FOR 1999 – 2002	237
TABLE 34:	FREE STATE FOCUS AREAS FOR 1999	238
TABLE 35:	PE TECHNIKON RESEARCH UNITS AND GROUPS	239
TABLE 36:	VAALE TRIANGLE TECHNIKON FOCUS AREAS FOR 1999	240
TABLE 37:	TECHNIKON SA RESEARCH FOCUS AREAS FOR 2000	240
TABLE 38:	TECHNIKON SA INSTITUTES IN 2000	241
TABLE 39:	INSTITUTIONAL FOCUS AREAS	242
TABLE 40:	NRF FOCUS AREAS FOR 2001	247
TABLE 41:	PRETORIA TECHNIKON FOCUS AREAS FOR 2002	248
TABLE 42:	NRF FOCUS AREAS FOR 2001	250
TABLE 43:	NRF FOCUS AREAS FOR 2002	250
TABLE 44:	FOCUS AREAS FUNDING	250
TABLE 45:	MASTER'S AND DOCTORAL GRADUATIONS	256
TABLE 46:	M AND D ENROLLMENTS IN RELATION TO M AND D GRADUATES	257
TABLE 47:	PER CAPITA POSTGRADUATE OUTPUT	257
TABLE 48:	COMPLETED PROJECTS FROM 1984 TO 2002	258
TABLE 49:	MASTER DIPLOMA AND DEGREE PROJECTS	259
TABLE 50:	COMPLETED PROJECTS IN THE CESM CATEGORIES	260
TABLE 51:	INSTITUTIONAL DISTRIBUTION OF UNITS EARNED	261
TABLE 52:	SAPSE UNITS AWARDED TO TECHNIKONS	261
TABLE 53:	INSTITUTIONAL GROWTH IN UNITS FROM 1998 TO 2003	262
TABLE 54:	PER CAPITA SAPSE UNIT OUTPUT PER TECHNIKON	263
TABLE 55:	PAPERS READ BY STAFF FROM 1999 TO 2002	263
TABLE 56:	CORRELATION BETWEEN STAFF AND PAPERS READ	264
TABLE 57:	PAPERS READ PER CAPITA	264

TABLE 58: SUMMARY OF INPUT, PROCESS AND OUTPUT

265

## LIST OF ACRONYMS

B Tech	Bachelor of Technology
CATE	College for Advanced Technical Education
CHE	Council on Higher Education
COTT	Central Organisation of Technical Training
CSD	Centre for Science Development
CTP	Committee of Technikon Principals
DoE	Department of Education
FRD	Foundation for Research Development
FTE	Full-time Equivalent
HEI	Higher Education Institution
HEMIS	Higher Education Management Information System
HEQC	Higher Education Quality Committee
M Tech	Master of Technology
NATED	Department of National Education
NEPI	National Education Policy Investigation
NHD	National Higher Diploma
NRF	National Research Foundation
NWG	National Working Group
RCD	Research Capacity Development
SAMI	South African Mechanics' Institution
SASMT	South African School of Mines and Technology
SAPSE	South African Post-Secondary Education
SERTEC	Certification Council for Technikon Education
SET	Science, Engineering and Technology
SETI	Science, Engineering and Technology Institution
SMME	Small, Medium and Macro enterprises
THRIP	Technology and Human Resources in Industry Programme
UoT	University of Technology
VMI	Verulam Mechanics' Institute

## CONTENTS

	PAGE
DECLARATION	ii
ABSTRACT	iii
OPSOMMING	iv
ACKNOWLEDGEMENTS	v
DEDICATIONS	vi
LIST OF FIGURES AND TABLES	vii
LIST OF ACRONYMS	x
CHAPTER ONE	
INTRODUCTION	
1.1 BACKGROUND	3
1.2 PROBLEM STATEMENT	4
1.3 RESEARCH OBJECTIVES	6
1.4 METHODOLOGY	6
1.5 CHAPTER OUTLINE	10
CHAPTER TWO	
AN HISTORICAL PERSPECTIVE ON RESEARCH AT TECHNIKONS IN SOUTH AFRICA	
2.1 INTRODUCTION	14
2.2 PROVINCIAL TECHNICAL EDUCATION FROM 1828 TO 1909	16
2.2.1 The establishment of Mechanics Institutes in South Africa	17
2.2.2 The role of industrial developments in technical education	18
2.2.3 The colonial apprenticeship training system	19
2.2.4 The establishment of Trades Schools	20
2.2.5 The establishment of Technical Institutes	21

2.2.6	Early advanced technical education	23
2.2.7	The organisation and financing of technical education	26
2.2.8	Concluding remarks	27
2.3	UNION TECHNICAL EDUCATION FROM 1910 TO 1923	28
2.3.1	The Conference on Technical, Industrial and Commercial Education	29
2.3.2	The official status of South African technical education	31
2.3.3	The growth of technical colleges	34
2.3.4	The role of technical colleges in higher education	36
2.3.5	Concluding remarks	37
2.4	NATIONAL VOCATIONAL AND TECHNICAL EDUCATION FROM 1924 TO 1947	38
2.4.1	The university aspirations of the technical colleges	39
2.4.2	The Van der Horst Commission	41
2.4.3	The involvement of the Association of Technical Colleges	41
2.4.4	Financial relations between the Union government and the provinces	43
2.4.5	Centralised organisation of technical training	44
2.4.6	The Eybers Committee	45
2.4.7	Further growth in the technical college sector	45
2.4.8	The findings and recommendations of the De Villiers Commission on vocational education	46
2.4.9	Concluding remarks	49
2.5	ADVANCED TECHNICAL EDUCATION FROM 1948 TO 1978	49
2.5.1	Reactions to the De Villiers Commission's recommendations	50
2.5.2	Relations between the Association and the Education Department	51
2.5.3	Advanced technical education developments	53
2.5.4	The CATEs	56

2.5.5	Research developments	60
2.5.6	Concluding remarks	61
2.6	TECHNIKON EDUCATION FROM 1979 TO 1993	62
2.6.1	Institutional name change	63
2.6.2	The establishment of the historically disadvantaged technikons	64
2.6.3	The Committee of Technikon Principals	65
2.6.4	Technikon education in transformation	66
	(a) The technikon instructional programmes	
	(b) The co-existence of the technikon and the university	
	(c) Technikon tertiary education	
	(d) The role and function of research in technikon education	
	(e) Technikon research financing	
	(f) The initial restructuring of technikon research funding	
	(g) Academic quality assurance	
2.6.5	Concluding remarks	84
2.7	CONCLUSION	85
CHAPTER THREE		
TECHNIKONS IN THE POST-APARTHEID HIGHER EDUCATION LANDSCAPE		
3.1	INTRODUCTION	92
3.2	EMERGING HIGHER EDUCATION CHANGES FROM 1991 TO 1993	93
3.2.1	The DoE's Renewal Strategy	94
	(a) Declining economic growth	
	(b) Equal educational opportunities	
	(c) Managerial effectiveness	
3.2.2	The National Education Policy Investigation	99
	(a) Central control and post-secondary governance structures	
	(b) Post-secondary size and shape options	

3.2.3	Concluding remarks	102
3.3	THE HIGHER EDUCATION RESTRUCTURING PROCESS	106
3.3.1	Size and shape	107
	(a) The establishment of the CHE and the brief of the Task Team	
	(b) Diversity and differentiation in South African higher education	
	(c) Criteria for grouping South African HEIs	
	(d) The infusion of South African higher education with social purpose	
	(e) The previous versus the emerging higher education landscape	
	(f) Outcomes of the reconfiguration exercise	
	(g) The processes informing the higher education reconfiguration	
3.3.2	A single co-ordinated system	117
	(a) The purpose of the National Plan	
	(b) Steering mechanisms to effect higher education restructuring	
	(c) The features of a single national co-ordinated system	
	(d) The Ministry's response to the CHE model of diversity and differentiation	
	(e) Uniformity, UoTs and horizontal differentiation	
	(f) Institutional, programme and infrastructural collaboration and new forms of institutions	
3.3.3	The regional higher education profile	123
	(a) The NWG recommendations on institutional forms	
	(b) The CTP's response to the NWG recommendations	
	(c) The Ministry's response to the NWG recommendations	
	(d) The Ministry's proposals regarding the regional institutional landscape	
	(e) The regional merged HEI profile	
	(f) The CTP's response to the new institutional profile	
	(g) The guidelines for mergers and incorporations	
3.3.4	The restructuring of government technikon research funding	136
	(a) The inequalities between technikon and university subsidy research funding	

(b)	The alignment of research funding with the co-ordinated national priority system	
(c)	Output subsidy	
3.3.5	The restructuring of agency technikon research funding	146
(a)	The establishment of the NRF	
(b)	The establishment of the NRF Technikon Research Development Programme	
(c)	The establishment of research priorities and the focus area funding framework	
3.3.6	A new approach to quality assurance	149
3.4	CONCLUSION	151
 CHAPTER FOUR		
THE VISION, STRATEGIES AND PLANS FOR THE ESTABLISHMENT OF A RESEARCH CULTURE AT TECHNIKONS		
4.1	INTRODUCTION	155
4.2	THE GOVERNMENT'S PHILOSOPHY FOR TECHNIKON EDUCATION	156
4.3	THE CTP'S VISION FOR A RESEARCH CULTURE AT TECHNIKONS	158
4.3.1	The Research Philosophy for technikon education	158
4.3.2	The Research Philosophy for technikons in South Africa	161
4.3.3	The implementation of research and development programmes	165
4.3.4	Concluding remarks	167
4.4	THE INTRODUCTION OF RESEARCH FOR STAFF DEVELOPMENT	167
4.4.1	The transformation of the teaching culture	169
4.4.2	Staff research capacity	176
4.4.3	Concluding remarks	181
4.5	THE TYPE, FOCUS AND ORIENTATION OF RESEARCH AT TECHNIKONS	182
4.5.1	Industry innovation and problem solving	184



4.5.2	The technological nature of technikon education	185
4.5.3	Technikon research and technology transfer	186
4.5.4	Concluding remarks	189
4.6	THE PROVISION OF TECHNOLOGISTS	189
4.6.1	Acceptance of technikon student research	190
4.6.2	The creation of confidence in the technikon advanced diploma	191
4.6.3	The technological higher degree and research at technikons	193
4.6.4	Concluding remarks	196
4.7	CONCLUSION	198

## CHAPTER FIVE

### A PROFILE OF THE RESEARCH CULTURE AT TECHNIKONS

5.1	INTRODUCTION	204
5.2	INPUT FACTORS	206
5.2.1	Permanent full-time teaching staff with post-graduate qualifications	207
5.2.2	Post-graduate students	210
5.2.3	Financial support by the NRF	214
	(a) NRF Grants	
	(b) NRF Master's and Doctoral awards	
	(c) NRF grant holder-linked and free-standing bursaries	
	(d) Industry funding and NRF/THRIP grants	
5.2.4	Concluding remarks	224
5.3	PROCESS FACTORS	225
5.3.1	Master's and doctoral project activity	226
5.3.2	The establishment of focus areas	232
	(a) FRD Activity Areas	
	(b) The emergence of institutional research focus areas	

(c)	Centres of Excellence	
(d)	NRF Focus Areas	
(e)	The Technology Station Programme	
(f)	Alternative institutional structures to focus research	
5.3.3	Concluding remarks	254
5.4	OUTPUT FACTORS	255
5.4.1	Higher degree graduations	256
5.4.2	Higher degree project completion	258
5.4.3	SAPSE unit-earning outputs	260
5.4.4	Papers read at conferences	263
5.4.5	Concluding remarks	264
5.5	CONCLUSION	265

## CHAPTER SIX

### CONCLUDING REFLECTIONS ON RESEARCH AT TECHNIKONS: THE JOURNEY FROM APPRENTICESHIP TRAINING TO TECHNOLOGICAL DEGREES

6.1	INTRODUCTION	270
6.2	THE EVOLVING TECHNICAL EDUCATION MISSION	271
6.2.1	The proliferation and institutionalisation of diversity in the provision of technical education	271
6.2.2	The continuing problematic process of differentiation between vocational and technical education	275
6.2.3	The development of the provision of formal centrally-controlled technical higher education	278
6.2.4	The differences of opinion between the Department of Education and the sector officials regarding the nature of technical higher qualifications	281
6.2.5	The inclusion of research in the technical education mission	284

6.3	THE TRANSLATION OF THE VISION INTO STRATEGIES AND PLANS FOR ESTABLISHING A RESEARCH CULTURE	286
6.3.1	The vision of research at technikons	287
6.3.2	The gap between the vision, strategies, plans and performance	290
	(a) The gap between the advancement of the qualification structure and the output of technologists	
	(b) The gap between the adoption of the applied research orientation and the output of technologists	
	(c) The gap between the advancement of the qualification structure and staff development.	
	(d) The gap between the managerial focus area approach and research output	
6.4	IN CONCLUSION	300
	LIST OF REFERENCES	303

# **CHAPTER ONE**

## **INTRODUCTION**

## CHAPTER ONE

### INTRODUCTION

	PAGE
1.1 BACKGROUND	3
1.2 PROBLEM STATEMENT	4
1.3 RESEARCH OBJECTIVES	6
1.4 METHODOLOGY	6
1.5 CHAPTER OUTLINE	10

## CHAPTER ONE

### INTRODUCTION

#### 1.1 BACKGROUND

The technical college sector started planning and putting mechanisms into place to provide for the introduction, sustainment and development of research as early as the late 1960s. Provision was made for the presence of research as a prominent part of technikon education as well as to enhance the education and training function of colleges, as early as 1967, when the Colleges for Advanced Technical Education (CATEs) were first established (Beukes, 1984; Department of National Education, 1988; Pittendrigh, 1988; Steyl, 1989).

The drive to develop the research function of technikons continued into the 1970s and was strongly supported by the technikon officials at the time of the establishment of technikons in 1979. The technikon principals held a research seminar in 1979 during which they accepted that research had a role to play in technikon education (Knoll, 1982; Pittendrigh, 1988).

The developmental path of research at technikons, the evolvement of the technical education mission and the eventual research culture was characterised by continuous debates between the Education Department and technikon officials. These debates shaped the role, function, nature and scope (i.e. the quantity and quality) of research at technikons.

The two-fold purpose of introducing research at technikons was described by technikon officials as including the development of staff and its contribution to the supply of much-needed technological human resources to the South African labour market (Goode, 1978; Shippey, 1987; Van Rensburg, 1985).

The development of research was taken further by efforts to establish a culture of research at technikons set in motion by certain plans and strategies.

However, in spite of deliberate efforts to develop a research culture, a gap existed between the vision of a research culture and the statistical profile of the research activity, such as the number of staff with appropriate post-graduate qualifications and the number of technologists graduating from the technikons from the mid-1980s onwards.

With the above strategies and plans the technikon officials aimed firstly at enhancing the image of technikons, secondly broadening the scope of the education and training function to provide South Africa with technologists, and thirdly, developing technikon staff by building their capacity to do research.

The gap between the vision of the technikon officials and the reality of research activity, indicating the extent of the research culture, forms the object of this study.

## 1.2 PROBLEM STATEMENT

The above-described gap has led to the questioning of the direction that developments in the technikon sector took. On the one side of the gap are the vision, plans and strategies to develop a research culture and on the other side are the statistics revealing the outcome of the efforts of the technikon officials.

Firstly, the statistics indicate that an average of 31% of technikon staff were in possession of a post-graduate (master's or doctoral) qualification during the period 1998 to 2002. Such a figure is, in retrospect, a matter of concern, because of the impact this might have had on the development of technikon student research and the ability of the technikons to provide South Africa with the necessary technologically skilled human resources. Further, in spite of an average of 35% of Bachelor of Technology (B Tech) and National Higher Diploma (NHD) students continuing with their studies at the post-graduate level from 1999 to 2002, this percentage only represented 1% of the total technikon student enrollment at the time.

Regarding the contribution played by the funding of research at technikons, this dissertation details the role of the National Research Foundation (NRF). Although the NRF consciously increased its support and developed new support programmes to build research capacity, it could not, on its own, meet the daunting challenge of firmly establishing the envisaged research culture at all the technikons concerned. The statistical reality of the outcome of the managerialistic approach adopted by the CTP to the establishment of a research culture is also discussed in this study.

Lastly, attention needs to be focused on the gap between the vision, plans and strategies aimed at establishing a research culture and the statistical evidence relating to the paucity of the existing research culture, which led to the lack of productive research output of technikons. From 1998 to 2002, the number of master's and doctoral graduates amounted to a total of 1 077 students, with only 28% of the registered degree-based research higher qualifications projects being completed between 1993 and 1998.

The research productivity and output picture is, however, not completely negative. The percentage of master's and doctoral enrolments increased steadily by more than 20% per year from 1998 to 2002. The number of research publications also increased by 88% during the mentioned period, while the number of papers read at conferences steadily increased. All research achievements of staff in the technikon sector in recent years must be measured against their origin in a miniscule basic starting point. Research output published in accredited journals, for instance, was awarded subsidy units for the first time for the 1992 subsidy in 1990. This effectively means that research activity and productivity at technikons should be judged for its value in terms of, and in proportion to, the limited input factors that technikons had available for research.

The significance and contribution of the current study lies in the provision of a description, interpretation and analysis of technikon education in the pre-restructured and pre-merger higher education landscape, the history of technical education before and after the Second World War as well as



technikon education during the apartheid and post-apartheid dispensation in South Africa.

This study provides documented evidence of the complex, diverse and multi-faceted evolvement of the technical education mission that led to the introduction of research at institutions that currently belong to the past of a new species of university (Martin, 2005), namely the Universities of Technology (UoTs). The UoTs consist of 10 of the 15 former technikons. The determination of the role, function, scope and nature of research will remain a prominent part of the developmental processes that are set to influence the trajectory and to form the future ethos of the education offerings of the UoTs.

### 1.3 RESEARCH OBJECTIVES

Following the discussion above, the objectives of the study were formulated as follows:

- to document and discuss in detail the history of the technikon sector in South Africa;
- to establish how the research function at technikons developed, focusing on when, how and for what purpose the inclusion of a research mission came about; and
- to describe and analyse the scope, content, volume and nature of research in the technikon sector, as it has manifested itself during the recent past.

### 1.4 METHODOLOGY

The thesis commences with a narrative description of the history of research in the technikon movement, as well as of the history of the national education policy with regard to technical higher education and research.

Presenting the history of research at technikons entailed the use of key primary documents, as well as of secondary information sources. Chapter Two presents an interpretation of the developments, from 1828 to 1993.

Examples of primary documents consulted are:

- Department of Education (DoE) policy documents;
- Committee of Technikon Principals (CTP) annual reports;
- the Goode Commission Report of the inquiry into the training, use and status of engineering technicians in the Republic of South Africa;
- *Technikons in South Africa*, by Pittendrigh (1988);
- educational reports, such as the 1928 Van der Horst Report, the 1951 De Villiers Report and the 1964 Mönning and Schumann Reports; and
- a variety of relevant vocational, technical education, apprenticeship and higher education acts.

A number of methodological challenges were attached to the current study. Such challenges include the location and selection of the most appropriate and authoritative sources, as well as the reduction of the available data, and the provision of a body of work open to the processes of deduction, interpretation and synthesis aimed at providing a balanced and chronologically correct presentation of the events under discussion.

Due to the momentum that higher education policy developments embarked on, as well as the envisaged impact of the developments concerned on research at South African technikons, I include a review of the higher education restructuring process that occurred from 1991 to 2004. These developments, discussed in Chapter Three therefore largely focuses on the restructuring of technikons within the paradigm of the higher education changes that led to the development of a new institutional landscape inclusive of the UoTs.

The historical perspective presented on the research developments that took place at the technikons described in Chapter Two, ends with a discussion of technikon education from 1979 to 1993.

The latter year was chosen as a cut-off point for the chapter as being the year prior to that in which the first democratic elections, which served to introduce a new dispensation in South Africa, were held. Chapter Three, accordingly, starts with a description of the earliest higher education changes suggested by the government-driven Education Renewal Strategy and the investigation undertaken by the National Education Policy Investigation in 1992. The discussion continues to cover the period up to the completion of the higher landscape reconfiguration, including the establishment of the UoTs.

The description of the vision, strategies and plans for the establishment of a research culture at technikons is based on various sources. The sources include documentation dating from the inception of the Colleges for Advanced Technical Education in 1967 up to that of the 1990s, including the CTP research philosophies published in 1989 and 1998 and *The Guidelines for the implementation of research and development at technikons*, which was published in 1999. The results of these overviews are discussed in Chapter Four.

The issues highlighted in this discussion relate to the two-fold purpose of introducing research at technikons continuously cited by the sector officials, namely staff development, as well as to provide sufficient technologists to satisfy the needs of the South African labour market. As a result, attention is paid to the nature, scope, content and volume of research (the research culture) at technikons, which are the issues forming the basis of the framework presented in Chapter Five.

The systems framework described in Chapter Five reflects my interpretation of the strategies and plans implemented by the technikon sector in order to establish the desired research culture. The framework focuses on the statistics and quantitative data relating to the period 1984 to 2002. The statistics are arranged in terms of an input-process-output framework based on the model designed to summarise Chapter Four.

The vision, strategies and plans, as discussed in Chapter Four, are represented by the input factors and the process factors, while the outcome of these strategies and plans are mostly represented by the relevant output factors.

The statistical profile provides research statistics for the period from 1984 to 2002 and includes all 15 technikons established from 1979 to the late 1980s. The purpose of the profile is to indicate the volume of research and the nature of research done at technikons during that period. Although 2003 was officially the last year of the existence of the technikons, the period from 1984 to 2002 was chosen for two reasons. Firstly, the first Master's Diploma projects were registered at technikons in 1984 and secondly, technikon statistics provided from 2003 onwards included statistics for data emanating from two of the earliest merged institutions forming the Durban Institute of Technology.

In order to present the nature, scope, content and volume of research being done at technikons both credibly and fairly, a number of indicators have been selected for inclusion in the statistical profile of the research culture. The indicators include the current and completed research projects dating from 1984 to 1999, the master's and doctoral enrolments from 1999 to 2002, as well as the master's and doctoral graduations for the same period.

In addition, the patterns and trends in the distribution of research funding, including NRF master's and doctoral grants, as well as other NRF grants and funding from external sources, were examined.

In order to determine the volume of research done by the staff of the time, DoE subsidy-earning research output, staff qualifications and the participation of staff in conferences were also explored. The development of institutional focus areas and Centres of Excellence, as well as Foundation for Research Development (FRD) Activity areas and NRF focus and niche areas are also included in the discussion to determine the impact of the managerialistic approach adopted to establish a research culture.

The statistical profile presents a useful entry point to the debate about the extent to which a research culture has been established at South African technikons, as it effectively indicates the nature of the gap between the vision, strategies and plans and the statistical reality.

The role and function of research at technikons, as envisaged by the Committee of Technikon Principals, discussed in Chapter Four, reflects the objectives for the introduction of research at technikons.

The framework explored in Chapter Five is based on the summarising model presented at the end of Chapter Four. The exploration aims to facilitate discussion of the gap existing between vision and the reality of plans and strategies implemented in order to establish a research culture.

The comparison of vision and reality is concluded in Chapter Six with reflections on the technikons' journey from apprenticeship training to technological degrees and the role that research played in this journey.

## 1.5 CHAPTER OUTLINE

### 1.5.1 Chapter One: Introduction

### 1.5.2 Chapter Two: An historical perspective on research at technikons in South Africa

### 1.5.3 Chapter Three: Technikons in the post-apartheid higher education landscape

### 1.5.4 Chapter Four: The vision, strategies and plans for the establishment of a research culture at technikons

### 1.5.5 Chapter Five: A profile of the research culture at technikons

### 1.5.6 Chapter Six: Concluding Reflections on Research at Technikons: The technikons' journey from apprenticeship training to technological degrees

## **CHAPTER TWO**

### **AN HISTORICAL PERSPECTIVE ON RESEARCH AT TECHNIKONS IN SOUTH AFRICA**

## CHAPTER TWO

### AN HISTORICAL PERSPECTIVE ON RESEARCH AT TECHNIKONS IN SOUTH AFRICA

	PAGE
2.1 INTRODUCTION	14
2.2 PROVINCIAL TECHNICAL EDUCATION FROM 1828 TO 1909	16
2.2.1 The establishment of Mechanics Institutes in South Africa	17
2.2.2 The role of industrial developments in technical education	18
2.2.3 The colonial apprenticeship training system	19
2.2.4 The establishment of Trades Schools	20
2.2.5 The establishment of Technical Institutes	21
2.2.6 Early advanced technical education	23
2.2.7 The organisation and financing of technical education	26
2.2.8 Concluding remarks	27
2.3 UNION TECHNICAL EDUCATION FROM 1910 TO 1923	28
2.3.1 The Conference on Technical, Industrial and Commercial Education	29
2.3.2 The official status of South African technical education	31
2.3.3 The growth of technical colleges	34
2.3.4 The role of technical colleges in higher education	36
2.3.5 Concluding remarks	37
2.4 NATIONAL VOCATIONAL AND TECHNICAL EDUCATION FROM 1924 TO 1947	38
2.4.1 The university aspirations of the technical colleges	39
2.4.2 The Van der Horst Commission	41
2.4.3 The involvement of the Association of Technical Colleges	41
2.4.4 Financial relations between the Union government and the provinces	43
2.4.5 Centralised organisation of technical training	44
2.4.6 The Eybers Committee	45

2.4.7	Further growth in the technical college sector	45
2.4.8	The findings and recommendations of the De Villiers Commission on vocational education	46
2.4.9	Concluding remarks	49
2.5	ADVANCED TECHNICAL EDUCATION FROM 1948 TO 1978	49
2.5.1	Reactions to the De Villiers Commission's recommendations	50
2.5.2	Relations between the Association and the Education Department	51
2.5.3	Advanced technical education developments	53
2.5.4	The CATEs	56
2.5.5	Research developments	60
2.5.6	Concluding remarks	61
2.6	TECHNIKON EDUCATION FROM 1979 TO 1993	62
2.6.1	Institutional name change	63
2.6.2	The establishment of the historically disadvantaged technikons	64
2.6.3	The Committee of Technikon Principals	65
2.6.4	Technikon education in transformation	66
	(a) The technikon instructional programmes	
	(b) The co-existence of the technikon and the university	
	(c) Technikon tertiary education	
	(d) The role and function of research in technikon education	
	(e) Technikon research financing	
	(f) The initial restructuring of technikon research funding	
	(g) Academic quality assurance	
2.6.5	Concluding remarks	84
2.7	CONCLUSION	85



## CHAPTER TWO

### AN HISTORICAL PERSPECTIVE ON RESEARCH AT TECHNIKONS IN SOUTH AFRICA

#### 2.1 INTRODUCTION

The historical perspective on technical higher education and research at technikons in South Africa provided in this chapter is devoted to the period up to the end of the apartheid era in 1993. The history starts with an overview of the technical education offered by the Mechanics Institutes and the railway and mining apprenticeship system stretching from the nineteenth century up to the early 1900s.

The purpose of the discussion is to show the role that diversity, the differentiation between vocational and technical education, the development of the provision of formal centrally-controlled technical higher education and the differences of opinion between the Department of Education and the sector officials played in the evolvement of the technical education mission. I show how the changing name of the institutes from Mechanics Institutes, to Technical Institutes, then Technical Colleges, to Colleges for Advanced Technical Education, then Technikons, until their final appellation as UoTs – reflects more substantive and fundamental shifts in the technical education mission and research than mere name changes.

The narrative description of the history of South African technical higher education and research developments has been organised according to the following divisions:

- the period of provincial technical education from 1828 to 1909;
- the period of union technical education from 1910 to 1923;
- the period of national vocational and technical education from 1924 to 1947;
- the period of advanced technical education from 1948 to 1978; and
- the period of technikon education from 1979 to 1993,

providing a framework for the themes central to the development of technical higher education discussed in the thesis, such as the transformation of the South African education model, the new meanings continuously attached to concepts,

the drift from technikon-type (diploma) education to university-type (degree) education, the “dichotomy” between technikon and university research and the strategic versus the pedagogic motivation for the introduction of research at technikons.

In the mid-1850s a number of events contributed to early technical education developments in South Africa, first of which was the establishment of the earliest Mechanics Institutes in South Africa. I show how these institutes provided the model for early formal technical education in South Africa as well as how the discovery of gold and diamonds and the subsequent development of apprenticeship training was co-instrumental in the unfolding of the early history of these institutes.

In 1895, Trades Schools were established as an alternative to the apprenticeship system. In the early 1900s, these schools developed into technical institutes, which became the forerunners of technical colleges. The Trades Schools later developed into technical high schools. During this period the initial differentiation of vocational education from technical education took place. Efforts were made at the time to establish an appropriate image for technical education and the organisation of technical education became a prominent item on the educational agenda.

A key event that occurred during the second period, from 1910 to 1923, was that of the holding of the first Conference on Technical, Industrial and Commercial Education in 1911. The then Minister of Education, Dr Malan, commissioned Professor Snape to audit technical education activities in the Union in order to gain an accurate official picture of their status. The issue of centralised versus decentralised control over technical education was tabled for discussion. The Union Department of Education was subsequently established in 1919 in order to formalise the provision of higher education. One of the significant features of the development of technical higher education during this period was the ‘upgrading’ of technical institutes to technical colleges in the mid-1910s.

From 1924 to 1947, the technical education sector had to deal with a series of difficult situations. The first was the attempt by the Natal Technical College to offer technology degree courses and the second was what appeared to be aspirations for university status manifested by the technical colleges.

Another key event was the appointment of the Van der Horst Commission in 1926, aiming at addressing the issue of overlapping functions between technical colleges and universities. The financial relations between the Union Government and the provinces, as well as control over technical education, also became points of debate during this period.

The Second World War had a positive influence on developments during this period. The War led to the expansion of the scope, as well as of the number, of colleges aimed at assisting with the provision of the larger number of apprentices required to support the country in its war effort.

The fourth period in the history and development of technical higher education dates from 1948 to 1978. During these years, the important process of conceptualising secondary vocational and advanced technical education took place. The De Villiers Commission, appointed in 1945 in order to investigate the status of vocational education in South Africa, largely contributed to this process. Two acts formalised the developments taking place during these years: the Apprenticeship Act No. 28 of 1951 and the Vocational Education Act No. 70 of 1955. A third act, the Advanced Technical Education Act No. 40 of 1967, led to the establishment of Colleges for Advanced Technical Education. This act can be seen as having heralded a significant period in the history of South African technical higher education.

The real 'shaping' of advanced technical education in South Africa took place between 1979 and 1993. The first elements of advanced technical education were the extension of the qualification structure to include a Higher Diploma and the raising of the entrance requirements in the mid-1970s. In 1979, the CATEs were redesignated technikons. The 1978 Goode Commission's investigation contributed significantly to the development of advanced technical education at the time. The Commission's report, released in 1979, proposed a further extension of the qualification structure to include a six-year diploma, including a research component, obtainable from technikons. The scope, character, nature, tasks and goals of technikon education were also further developed during this period. In addition, the tertiary and technological nature and career orientation of technikon education received closer attention than it had in the past. This period also witnessed the first changes in research funding for technikons, culminating in the publication of the National Education Policy in 1992.

## 2.2 PROVINCIAL TECHNICAL EDUCATION FROM 1828 TO 1909

The earliest forerunners of technical education in South Africa were the Mechanics Institutes, established in the Cape and Natal in the mid-nineteenth century. Their origins and the role that the discovery of gold and diamonds played in apprenticeship training at the time are discussed in this thesis. The founding of the Trades Schools in the mid-1890s and the Technical Institutes around the turn of the century is also outlined. In addition, attention is paid to the development of early advanced technical education and to the struggle of technical education to rid itself of the image of serving as a provider of education for the academically less gifted. Although these developments focused on the manner in which provision was made for technical education in the early provincial dispensation, the process of establishing an education model best meeting the country's demand for technical expertise should not be overlooked. Acknowledging an education model in development, notice should, however, be taken of how diversity characterised the institutional types and levels at which technical education was provided.

### 2.2.1 The establishment of Mechanics Institutes in South Africa

The earliest South African technical education developments took the form of Mechanics Institutes, closely in line with similar developments taking place in Great Britain at the time (Pittendrigh, 1988; Rees, 1957). According to Pittendrigh (1988), Natal was the first colony to establish a Mechanics Institute, based in Durban in 1853, which according to Plug (1993), mostly focused on the provision of library services.

According to Plug (1993:97), the Mechanics Institutes in Britain "...were probably the most important providers of adult education, particularly in scientific subjects. Hundreds of these institutes arose all over Britain from the 1820s onwards to educate the working classes."

Plug (1993) describes the development of these institutes, referring specifically to the establishment of the London Mechanics Institution and the Sheffield Mechanics Institute, which both focused on providing instruction in scientific subjects, such as general science, mechanics, astronomy and chemistry, as well as in the literature and arts.

Plug (1993) highlights that the SA Mechanics' Institution (SAMI) was already established in Cape Town in 1828, focusing on subjects such as natural and experimental philosophy, mathematics and mechanics aimed at assisting the colony in the fields of agriculture and mineralogy. The SA Mechanics' Institution did, however, not exist for very long, with the objective of this institute apparently differing from those of the other Mechanics Institutes established in the other colonies at the time. The Mechanics Institute in Durban, therefore, was not the first mechanics institute founded in South Africa, as Pittendrigh indicates.

In addition to the establishment of SAMI in Cape Town in 1828, further institutes were established in Port Elizabeth in 1849, in Cape Town and Durban in 1853, in Graaff-Reinet in 1859 and another in Natal, namely the Verulam Mechanics' Institute (VMI), prior to 1868 (Plug, 1993).

The first labour newspaper, the *Cape Mercury and Weekly Magazine*, established in the Cape in 1859, reported, in connection with the SA Mechanics' Institution, on "...attempts by benevolent liberals to establish a Mechanics' Institute to instruct and entertain artisans" (<http://www.anc.org.za/books/ccsa/01.html:01>).

The establishment of the mechanics' institutes at this stage amounted to an attempt by educationists of the time to provide formal technical instruction to artisans in order to supplement the practical side of their skills training. In this regard, the mechanics' institutes of Scotland provided a fitting example and appropriate role model. Later, the Trades Schools assumed the theoretical side of the apprenticeship training.

#### 2.2.2 The role of industrial developments in technical education

Due to the underdeveloped state of industry in the colonies in the nineteenth century, little need existed at the time for technical education. The technical education offering consisted of training in no more than the three Rs namely, reading, writing and arithmetic, as well as elementary training relating to trades (Pittendrigh, 1988).

The discovery of diamonds in Hope Creek, a tributary of the Orange River, in 1867, and the development of gold mining on the Witwatersrand, in 1886, would, however, radically alter this scenario.

The establishment of the new industries, the development of the gold and mining industries, and the expansion of the South African Railways quickly created a burgeoning demand for technicians and apprentices (Lurie, 2000; Pittendrigh, 1988; Van der Spuy *et al.*, 1975). The urgent need for large numbers of suitably trained apprentices was also fuelled by the diverse technical job requirements demanded by the railways. As a result, the apprenticeship system as a mode of delivery of technical training was mostly an attempt to meet the demand for mechanical and technical skills which accompanied growing industrial development.

### 2.2.3 The colonial apprenticeship training system

As a result of the need for trained artisans, the colonial railways managements introduced an apprenticeship training system. The system mostly included training of a practical nature in a particular trade. The subjects typically taught consisted of machine construction, practical mathematics and carriage-building (Pittendrigh, 1988; Rees, 1957).

The Natal Government Railways was the first to start apprenticeship classes in the railways workshops in Durban in 1884, while the first apprenticeship classes to be organised in the Cape Colony were held by the Cape Government Railways at the Salt River Works in 1890 (Pittendrigh, 1988; Rees, 1957).

In Uitenhage, the first apprenticeship classes started in 1895 (Pittendrigh, 1988). According to Van der Spuy *et al.* (1975), these classes served as the starting point for one of the first industrial schools. The evening technical education classes conducted at the Salt River Works gave rise to the country's first technical colleges (Pittendrigh, 1988). Parallel to the railway apprenticeship classes, "...the Cape Colonial Government decided in 1894 to support the training of mining engineers...". (Pittendrigh, 1988:109). Such training led to the establishment of the School of Mines at Kimberley in 1896. Though the School of Mines had to close on 14 October 1899, during the siege of Kimberley that took place during the Anglo-Boer War, it re-opened in July 1900 (Lurie, 2000). In the Cape, a railway school was first established in East London by the Cape Government Railways in 1902. The successful completion of Standard Five served as the entrance level to the school. The student component consisted of railway apprentices, who attended classes in sketching, machine and carriage drawing and graphics (Pittendrigh, 1988).

The contribution that John Orr, later known as the 'father of technical education', made to the development of technical education at the time was significant. John Orr's role in keeping the mining workshops open was essential for maintenance of the Anglo-Boer war effort. In 1908 "...this far-seeing man continued his campaign to establish a sound technical education for apprentices and artisans" (Lurie, 2000:59, 61).

In Pretoria, railway apprenticeship classes were started by the Central South African Railways in 1902 (Pittendrigh, 1988). After the establishment of the Transvaal Technical Education Commission in 1904, mining students were transferred from Kimberley to Johannesburg (Pittendrigh, 1988). A commission "...recommended [in 1903] that temporary premises be acquired in Johannesburg to offer technical education embracing the whole of the mining course" (Lurie, 2000:9).

In the Orange Free State, railway apprenticeship classes were started by the South African Railways in Bloemfontein in 1904 (Pittendrigh, 1988).

In summary, the above discussion shows how, during this initial period, Natal took the lead in 1884 with apprenticeship training. The Cape then followed with provision of training firstly in Salt River in 1890, Kimberley in 1894, then in Uitenhage in 1895, and lastly in East London in 1902. In the same year, the South African Railways started its apprenticeship system in the Transvaal, with, in 1904, the Free State following suit.

#### 2.2.4 The establishment of Trades Schools

Up until this point, technical education had largely been of a practical nature provided in the form of the apprenticeship system first instituted by the railways.

A new development in technical education came about with the establishment of Trades Schools, which mostly originated from a need felt by the Education Department to formalise technical education and to include a more broadly-based theoretical element in trades training. In actual fact, the Department aimed to replace the informal apprenticeship system of the railways with a more formal government-co-ordinated trades training. This initiative also led to the addition of more inclusive entrance requirements.



For instance, the entrance requirement for the Trades School in the Transvaal was that candidates had to be at least 13 years of age, who had at least passed Standard Four. Entrance requirements would later play a major role in the process of differentiating between different types of further education in South Africa.

The first South African Trades School was established in Uitenhage on 2 April 1895, under the headmastership of Mr F. Doëge. The next headmaster, the Scot, Mr W. Jannet, was appointed in 1898. From 1904, the Trades School provided education up to Standard Six level. This development took place in the same year that apprenticeship training was started in Uitenhage.

When the control of the school was taken over, in 1927, by the Union government, the entrance requirement for the school was raised to Standard Six. This School continued to be a Trades School until 1956, when the name of the school was changed to the Daniel Pienaar Technical High School (107<sup>th</sup> Anniversary Reunion Celebrations of the Daniel Pienaar Technical High School, 26–27 April 2002).

A Trades School was opened in the Transvaal in 1909 under the auspices of the Transvaal Education Department. The trades offered by the school included mechanics, woodwork, wagon-building, printing, blacksmithing, plumbing and electrical work (Pittendrigh, 1988).

The colonial and republican Trades School developments started in the Cape Colony in 1895, followed by those embarked on in the Transvaal, mostly from 1903 onwards, and then in Natal, largely after 1904.

#### 2.2.5 The establishment of Technical Institutes

Technical Institutes came about in an effort to offer organised technical education to apprentices at a more advanced level than the education mostly offered by the Trades Schools at secondary level at the time.

In the Transvaal, a Technical Institute was established in August 1903 that offered evening classes for apprentices on the Witwatersrand from 1905 onwards (Lurie, 2000; Rees, 1957).



According to Pittendrigh (1988:109), the Transvaal Technical Institute went through a number of developmental stages, becoming the Transvaal University College in 1906. In discussing this development, Lurie (2000:12) refers to the fact that, in addition to the technical subjects, the institute also provided instruction in "...arts and science subjects as well as in law". Consequently the name of the institute "...became inappropriate and was changed to the Transvaal University College in 1906.

In Natal, the Colonial Government appointed a commission in 1904 to investigate the technical education offerings of the colony (Van der Spuy *et al.*, 1975). The Commission found that the offerings available in Natal at the time did not compare favourably with the higher education developments taking place at that stage in other British colonies of a similar size. This finding led to the establishment of the Durban Technical Institute in 1907 (Van der Spuy *et al.*, 1975). Once again, educational developments in Natal were compared with overseas developments, reflecting colonial aspirations to raise the level of technical education to one higher than secondary.

The Durban Technical Institute had a Technical High School division providing vocational training to boys intending to enter technical occupations (Pittendrigh, 1988). The entrance requirement for the school was that candidates had to be at least 13 years of age, with a pass in Standard Six. The entrance requirements for the various Technical Institutes at the time indicated that technical education was, in fact, offered at a secondary level.

A further technical education development that took place in the Transvaal during this period was the opening of the Polytechnic in Pretoria in 1906 (Pittendrigh, 1988). No reference other than this one by Pittendrigh could be found in the literature indicating the continuation and development of, or the relation of the Polytechnic in Pretoria to, the technical institutes in existence at the time, which seemed the developmental path mostly likely to have been followed.

At the time, technical institutes started to phase out their high school divisions, paving the way for their development into technical colleges. The gap that originated as a result of this decision taken by technical institutes led to the development of Trades Schools into technical high schools, incorporating the former high school divisions of some technical institutes.

In Natal, the Pietermaritzburg Technical Institute came into existence in 1910. The Institute largely offered commercial classes and some technical classes for boys who had passed Standard Five (Van der Spuy *et al.*, 1975).

Clearer lines of division were now developing between the trades training offered by the technical high schools and the vocational education offered by the technical institutes, which would later become technical colleges. In terms of the developing education model, Mechanics Institutes and apprenticeship training classes were followed by formalised Trades Schools. Some Trades Schools developed into technical institutes and some into technical high schools. The technical institutes developed into technical colleges, but the prerequisite was that they stop all education offered by their high school divisions. This provided a natural opportunity for Trades Schools to develop into technical high schools.

#### 2.2.6 Early advanced technical education

Technical education developed more quickly in the Cape and Natal colonies than it did in the two Boer republics, despite the fact that gold was discovered in the Transvaal. This and the reasons for the inferior image suffered by technical education during these early years are explored in this part of the discussion.

The Cape Colony, as early as 1894, "...instituted a scheme providing for two years preliminary instruction to be given at the South African College, Cape Town..." (Lurie, 2000:9). The first two years were followed by a third year of technical instruction in Kimberley and a fourth in Johannesburg. The preparation of a report formed an essential part of the practical course (Lurie, 2000). The "...three years of study was followed by a year of specialised study leading to the Diploma of the Institute. In addition, after a further year of study or practical work and a thesis of sufficient merit on an approved subject, Associateship would be granted" (Lurie, 2000:12).

According to Lurie (2000:9), "The scheme did not receive universal acclaim. Many, especially members of the mining fraternity in the Transvaal, felt it rather ridiculous that a School of Mines should be established in the Cape rather than on the Witwatersrand." The exposition of the scheme of instruction points to early developments in advanced technical education and research, based on an extended qualification structure, as well as to the higher-level demands made on students in terms of the required thesis.

The manner in which technical education was organised in the Cape and Natal, patterned on the Mechanics Institutes, contributed to the more rapid development of technical education in the colonies than in the two Boer Republics. In addition to the contributory factor of the technical education initiatives in the colonies being well-organised, the two colonies concerned were also popular destinations for British immigrants. The immigrants, who mostly entered South Africa through the Cape and Natal harbours, brought with them the technical expertise which they had acquired as a result of the Industrial Revolution that took place in Britain between 1730 and 1850.

A further factor contributing to the more rapid advance of technical education in the Cape and Natal was that an efficient railway system was pivotal to the transporting of mining equipment from the coastal harbours to the inland mines. The technical demands made on employees to operate and maintain such a system fostered the development of apprenticeship training by both the Natal and Cape railway establishments. British settlers in South Africa at that stage were also used to the railway systems that were already well established in Britain by 1847.

In addition to the processes involved in differentiating vocational from technical education in terms of trades training, technical education at the time also suffered from an inferior image. The statement made in 1909 by the headmaster of Durban High School, Mr A.S. Langley, effectively illustrates the warped image of technical education overwhelmingly held at the time. Mr Langley warned learners at the school that those who did not meet the required social and academic standards would be sent to finish their education at the Mechanics Institute. Such misperceptions that technical education was of a lower level and of an inferior quality to academic education prevailed at the beginning of the twentieth century (Rees, 1957).

As a result, a biased public perception of institutions at which technical education was offered developed. Consequently, it became necessary consciously to promote an awareness of the value of technical education among the general public in an effort to improve the image of early technical education. Fortunately, a positive contribution to the development of technical education came about in 1907 with the appointment of Principal B.M. Narbeth as the first principal of the Durban Technical Institute.

According to Rees (1957:32), Narbeth was "...a sound scholar, a meticulous administrator, and an enlightened and progressive educationist...". The appointee "...grasped the significance of technical training, and its relevance to any sound national system of education...[and]...knew that technical education could make its own distinctive contribution to the realization...of the social and individual purposes of education" (Rees, 1957:33).

The synonymous use of the concepts 'technical' and 'vocational' education at the time truly reflected the situation, because technical education at that stage included the vocational education offered to artisans. However, no clear definitions had yet evolved as a means of conceptualising the content of vocational and technical education to such an extent that clear lines of differentiation could be drawn between the two.

Rees (1957:5) described vocational education as a trade being learnt on "...the artisan level...with no understanding of the basic principles underlying the techniques which made up their daily routine." Cognisance was already taken at an early stage of the absence of, as well as the need for, a type of training that would supply artisans with the knowledge of the principles underlying their work techniques.

Narbeth, however, had a clearer vision of vocational education, seeing this type of training as "...something more than learning a trade...a branch of education to be accepted in its own right, as best suited for the many who could not respond to the traditional academic disciplines, and as fulfilling fundamental social and communal needs" (Rees, 1957:33). For Narbeth, technical education constituted an alternative to a purely academic education. He further distinguished between a traditional, purely academic education and another 'stream' of education, which would gain a place in its own right and which would offer alternative education of the same value as that of a purely academic nature (Rees, 1957).

This distinction drawn by Narbeth between the two types of education, could be seen as planting the first "seeds" of a binary higher education system, which would come to dominate the South African higher education landscape for many years.

Despite the efforts of those such as Narbeth, technical education still struggled to shed its inferior image.

Stewart (1995:110) wrote, "The lower value placed on vocational education and training as compared to academic education has always bedeviled the effectiveness of South African education." Stewart (1995:110) adds that the "...misgivings in the university sector as technikons sought to award degree status on some of their programmes..." were an outflow of the above-mentioned lesser value attached to this type of education. This view also reflects the earlier crisis that arose as a result of the perceived university pretensions of the first technical colleges and the endeavours of the Natal Technical College to offer technology degree courses.

The discussion in this part of the chapter shows how some educational leaders distinguished between vocational and technical education, as two "types" of education and others differentiated vocational education from technical education by assigning a different level to each. This manner of differentiation would remain part of the technical education discourse for a long time without a committed view to either of the view points by the different bodies participating in educational discourse.

#### 2.2.7 The organisation and financing of early technical education

The developments from the mid-1850s to the early 1900s led to the need to address the organisation of South African technical education. In January 1902, the Education Advisor to the Higher Commissioner for the Transvaal and the Orange River Colonies arranged a conference in Bloemfontein on technical education under the aegis of the four then colonial heads of education departments (Rees, 1957).

One of the resolutions of this conference was "...that technical schools in connection with higher education should be established in order to meet the needs of the several colonies" (Malherbe, 1925:305–306 in Pittendrigh, 1988:109). The conference resolutions also emphasised the need for vocational education on a higher level, which led to the appointment of Technical Education Commissions in the Transvaal in 1903 and in the Orange River Colony and Natal in 1905 (Pittendrigh, 1988). Soon after the afore-mentioned conference, the issue of educational relations between the colonies and central government emerged. The development of this debate led to further developments in technical education, which culminated in the South Africa Act of 1909.

Attendant on the Act were a number of regulations regarding the educational relations between the provinces and the Union...[such as] "...limitations on the transfer from the provinces to the Union of any form of education not being clearly 'higher education'..." (Pittendrigh, 1988:113).

The South Africa Act of 1909 (1909:42) describes this proviso as follows: "Subject to the provisions of this Act and the assent of the Governor-General-in-Council...the provincial council may make ordinances in relation to matters...other than higher education, for a period of five years and thereafter until Parliament otherwise provides...". According to Rees (1957:76), it was "...not easy to draw a clear line of demarcation, particularly in the sphere of technical education, between the responsibilities of the central and of the provincial governments...".

The Union Government, therefore, made this provision in the absence of a clear definition of higher education, despite the fact that "...the control of 'higher education', which remained undefined in law until 1922, had been vested in the Union Government..." (Rees ,1957:76). The fact that, at this stage, 'higher education' was not clearly conceptualised by the Union policy makers ensured that the provinces continued to handle their own technical education affairs (Pittendrigh, 1988).

The unsatisfactory manner in which the financing of technical education was handled by the Union also contributed to the continuation of provincial control of all technical education. The South Africa Act of 1909 stipulated that a commission had to be appointed as soon as possible after the establishment of the Union (South Africa Act, 1909). The function of this commission would be "...to institute an inquiry into the financial relations which should exist between the Union and the provinces..." (South Africa Act, 1909:60). The financial relations between the Union Government and the provinces received attention as early as 1909, mostly in an attempt to solve the problem of who would exert control over technical higher education.

#### 2.2.8 Concluding remarks

The discovery of gold and diamonds resulted in an influx of British immigrants, who brought with them technical expertise and experience of a system of organised technical education.

The influx of such knowledge led to a more rapid development of organised technical education in the Cape and Natal colonies. The Boer republics, however, managed to attain a momentum of their own and also succeeded in placing technical education on a firm footing.

The early momentum of technical education in South Africa was stimulated by industrial developments accompanying the discovery of gold and diamonds. The issue around which technical education developments centred during these years was certainly the acknowledgement of the need to formalise, co-ordinate and centralise technical education in order to come to an understanding of who would be responsible for technical education, as well as to who would finance technical education in South Africa. This led to a distinction being drawn between practical apprenticeship training and theoretical vocational and technical education offered by institutions specially developed for this purpose.

A desire to differentiate between trades training and vocational education, as well as to determine the levels on which the education and training should be offered, arose and in this value of technical education in relation to a purely academic education also received attention. This differentiation process contributed to the evolving technical education mission aiming to develop an educational model that would best serve the needs of a South Africa becoming more industrialised.

### 2.3 UNION TECHNICAL EDUCATION FROM 1910 TO 1923

The above discussion highlights the diversified and distributed manner in which technical education took place up until 1909. This situation led to the desire to formalise the different aspects of technical education. Attention now turns to the impact of the establishment of the Union of South Africa in 1910 on the development of technical education, the decision to obtain an official 'picture' of the status of South African technical education, the holding of the Conference on Technical, Industrial and Commercial Education in 1911, as well as the appointment of Professor Snape to conduct an investigation into technical education.

A number of new concepts such as occupational training and industrial and commercial education were introduced that signifies a refinement of the process to develop an educational model that would best accommodate the type of



education needed to provide South Africa with the necessary technical human resources.

### 2.3.1 The Conference on Technical, Industrial and Commercial Education

With the merger of the Cape and Natal colonies with the two Boer republics, the Transvaal and Orange Free State, as the Union of South Africa on 31 May 1910, the organisation of technical education fell into the hands of private organisations. Occupational training, mostly provided by the railways and the mines, came to be offered exclusively within specific occupations (Department of National Education, 1988; Van der Spuy *et al.*, 1975). As a result, the control of technical education, railway apprenticeship and mining engineering training was spread out amongst the different provincial railway departments.

Minister F.S. Malan, the then Minister of Education, elaborated on this situation in the speech that he presented to the Conference on Technical, Industrial and Commercial Education held in Pretoria in November 1911. The "...Union Department of Education dealt with the South African School of Mines and Technology, at Johannesburg...[and]...the Railway Department had its schools for the apprentices in the workshops...while the Mines Department was conducting a miners' school on the Witwatersrand. In addition...the four Provincial Education Departments each..." applied their own systems of technical education (Malan, 1911:7).

As a result of the decentralised way in which technical education was being managed at the time, a review of the state of South African technical education became necessary (Pittendrigh, 1988). The main purpose of such a review was to see what was offered by whom.

For this purpose, Minister Malan had organised the previously-mentioned conference on Technical, Industrial and Commercial Education in Pretoria in November 1911. In his opening speech, the Minister reiterated the need for a review of the state of technical education. "...think...the desire to have more industrial and technical education introduced into our education system in South Africa is very well founded" (Malan, 1911:7).

Minister Malan also addressed the nature of industrial education, identifying the two distinct sides of South African industrial education present at the time. "There



is the social side, in regard to the raising of that part of the population which is gradually sinking and going back – the poor whites, who had to be taken out of their old environment in order to make useful citizens of them. There is the town side. We have a growing number of children in large centres like Johannesburg [and] Cape Town...with a bookish education, afraid to work..." (Malan, 1911:7).

This statement makes it clear that the view of the government of the day was that the development of technical education should be stimulated in order to address the existing imbalance between those with a "bookish education" and those requiring education in the more "useful" arts. In addition, something drastic had, therefore, to be done in order to ensure the participation of white people in the growing South African industrial sector. This is the first time that the concept of an "imbalance" between what has been perceived to be "academic education" and "technical education" was introduced in the discourse. This contributed to an early awareness of certain types of education for which separate institutions may have been required.

Another important outcome of the conference was the emphasis on the necessity of technical education, in light of the contribution that it was expected to make in the stimulation of the growth of secondary industries (Rees, 1957). The growing importance of technical education as a result of industrial growth has already been discussed. According to Pittendrigh (1988) some of the other prominent issues addressed during the conference that led to the taking of a number of resolutions regarding the formalisation of technical education in the country were those relating to:

- the central control of vocational education;
- the need for a national advisory board on technical education;
- the central syllabi;
- the existing examinations and certification in the field of technical education; and
- the appointment of organisers of technical education on behalf of the Union.

The issue of central Union control versus control by the provincial administrations was also addressed at the conference, when Minister Malan referred to the diverse nature of the control of higher education (Malan, 1911).

Reflecting still further on this issue, he referred to "...that basis of inductive and empirical knowledge which has accumulated through the centuries, which humanity has reasoned about and discovered by practical experience in carrying out industries and trades" (Snape, 1912:12).

As far as the apprenticeship system was concerned, Snape (1912:12) described the apprenticeship method as an "...old method...[that consisted of artisans learning]...very slowly by 'rule of thumb' from his master and fellow-artisan...". The value of technical education was seen in that it counteracted the lopsidedness of the artisan system that had resulted from the transitory involvement of artisans in one job after another, which, in effect, meant that they only became proficient in limited aspects of a particular industry.

Another problem of the apprenticeship method was the amount of time that lapsed between the acquiring of skills and the application of the skills in a specific working context. Snape (1912:13) wrote: "This has now been altered; by improved methods of intercommunication men quickly learn any developments in the rest of the world, new methods are quickly adopted, and the spirit of the world is to move with greater and greater speed. No country aspiring to be great can afford to remain behind nor outside this race for supremacy". Such a deduction led him (1912:13) to conclude: "All the more necessary then is the need for technical education to complete the deficiencies and gaps..." in the artisan system.

Snape (1912:13) also reflected on the status quo of technical education, as "...one in which the boy is wholly occupied during the day with technical instruction, and the other where this instruction is supplementary to the practice of his trade".

Table 1 presents Snape's classification of the two branches of technical education. A decision was taken, on the basis of Snape's report, that the time was right to assemble all interested parties to discuss the future of technical education (Pittendrigh, 1988).

The Union government, therefore, had to continue with its efforts to centralise the provision of technical education, as well as to work on a co-ordination model to ensure the placing of future technical education on a firm footing.

### 2.3.3 The growth of technical colleges

I discussed the establishment of technical institutes in the previous period and we now see how technical institutes developed into technical colleges and were declared higher education and placed under the Union Department of Education. The addition of what should have been classified as higher education in an attempt to address the issue of central versus provincial control, added a dimension to the differentiation process between vocational and technical education that so far has been absent from the debates. It serves as one of the earliest indicators of the contextual factors versus content factors in the process to conceptualise the various types of education forming part of the provisioning of education at the time.

The Cape and Natal Technical Colleges were the first two technical colleges to be placed under the authority of the central governmental education department (Higher Education Act No. 30 of 1923:382). This development paved the way for the establishment of more technical colleges, as well as for the 'upgrading' of some of the technical institutes to technical colleges.

In the Transvaal, the Arts side of the Transvaal Technical Institute was transferred to Pretoria and the two previously existing branches of this technical institute were finally separated in 1910. The Pretoria section retained the name of the Transvaal University College, while the Johannesburg section became the South African School of Mines and Technology (Lurie, 2000). Those technical institutes that did not develop in the same way did not evolve into institutions that came to form part of the emerging technical college sector and higher education.

The Durban Technical Institute became the Natal Technical College in 1915 (Van der Spuy *et al.*, 1975:707). The South African School of Mines first became a component of the new University of South Africa in 1916. The University then became the University College Johannesburg in 1920 and subsequently, in 1922, the University of the Witwatersrand (Lurie, 2000). The University of the Witwatersrand, the University of Pretoria and the Technikon Witwatersrand, therefore, had a common origin in that each developed either directly or indirectly

from the South African College in Cape Town and the School of Mines in Kimberley (Lurie, 2000).

In 1919, the former University College Johannesburg expanded its courses to include preliminary courses in mathematics, drawing and elementary physics. As instruction in such subjects was not seen to comprise legitimate university courses, a Technical Education Board was formed in November 1923 to take over these courses, as well as the apprenticeship classes (Lurie, 2000). The Board maintained control of these courses and classes until they found a home under the auspices of the Witwatersrand Technical Institute (Pittendrigh, 1988). The development of the University, with its attendant relocation to Milner Park, made it "...increasingly difficult for the University to continue the work. The Board...found itself handicapped by lack of funds and was of the opinion that vocational training on the Witwatersrand required far more co-ordination of effort and a greater and wider organisation" (Lurie, 2000:14).

The new definition of higher education was recorded in the Financial Relations Fourth Extension Act of 1922, enabling the Minister to address the major financial problems experienced at the Technical Colleges (Pittendrigh, 1988). A further result of this development was that the status of the Natal Technical College changed from that of a provincial to that of a state-subsidised institution and the college courses in engineering and commerce were recognised as being of university standard (Pittendrigh, 1988).

The development of technical institutes into technical colleges was a major breakthrough in the development of technical education, because the institutions now came to be accepted as higher education institutions (HEIs), capable of offering a specialised type of education.

Technical education in Cape Town developed from two separate sources, namely from the Railway Institute at Salt River, which offered classes to railway apprentices, and the South African College, a private venture (Rees, 1957). The classes of the South African College were taken over by the Cape School Board in 1909, while, in 1911, these two institutions amalgamated to form the Cape Technical Institute and, later, the Cape Technical College.

The Cape Technical College was therefore an extension of the establishment of the Technical Institute at Salt River in 1911, as well as of the evening classes previously provided by the South African College (Pittendrigh, 1988; Rees, 1957; Van der Spuy *et al.*, 1975).

#### 2.3.4 The role of technical colleges in higher education

The process of redefining higher education continued until the Financial Adjustments Bill became law in May 1922 (Rees, 1957). The Financial Relations Fourth Extension Act No. 5 of 1922, following on this Bill, finally clarified the concept 'higher education', with the new definition of higher education being added to the 1922 Statute. The Financial Relations Fourth Extension Act defined higher education as "...Education provided by such technical institutions as the Minister may declare to be places of higher education..." (Rees, 1957:146).

As a result of this legislation, the Natal Technical College and the Cape Technical College were respectively declared places of higher education on 1 October 1922 and 1 April 1922. Higher education now included the education provided by the Universities and University Colleges incorporated in terms of the new legislation, as well as the education provided by all technical institutes that the Minister of Education declared to be places of higher education.

These developments meant that none of the technical colleges concerned were permitted to retain their technical high school divisions where instructional at secondary level to address pre-apprenticeship training took place (Pittendrigh, 1988; Rees, 1957). A readiness to organise vocational and technical education activities only developed after the inclusion of the technical institutes into the field of higher education (Rees, 1957).

The Union government's involvement in the delivery of technical education increased in 1922, on promulgation of the first legislation on apprentice training, the Apprenticeship Act No. 26 of 1922. The Act applied to all institutions participating in the Government apprenticeship system, while it excluded "...any university or university college, or any normal, industrial, technical or trades school wholly or partly maintained out of public funds [and]...any person who, having obtained a diploma or degree...[who] is serving or desirous of serving in any works in order to obtain practical experience in qualifying as an engineer, or

who is a registered student in engineering at a university or university college" (Apprenticeship Act, No. 26 of 1922:118).

According to the National Department of Education of the time, the Apprenticeship Act stipulated that it was the duty of technical colleges to undertake "...the 'theoretical' part of apprentice training throughout the country" (Department of National Education, 1988:5). This development was one of the key factors contributing to the growth of technical education.

The Union government became even more involved in technical education when certain technical colleges in the larger centres were declared places of higher education. At the same time, the colleges were placed under the authority of the central education department in terms of the Higher Education Act No. 30 of 1923 (Department of National Education, 1988:5).

#### 2.3.5 Concluding remarks

The period from 1910 to 1923 was characterised by a number of technical education developments. An attempt was made during this time to formalise and provide structure to the delivery of technical education. The 1911 conference on Technical, Industrial and Commercial Education was a landmark event, largely because a number of developments in technical education emanated from the conference. A pivotal request arising out of the conference was that made for Snape to assess the current status of the country's technical education.

In addition, discussions and decisions relating to centralised versus decentralised control became part of the technical education agenda. This development led to an investigation into the financial relations existing between the Union Government and the provincial administrations of the time. The Apprenticeship Act of 1922 signaled continued government involvement and the development of technical institutes into technical colleges. The designation of the first two technical colleges as HEIs signaled a new era in the development of technical education.

An issue, arising from the previous discussion, that should not be overlooked is undoubtedly the shift that took place in the official providers of technical education.

The shift was one from distributed occupational training, which previously had taken place mostly within the occupations themselves, to formalised technical education, provided by institutions single-mindedly dedicated to this mission.

## 2.4 NATIONAL VOCATIONAL AND TECHNICAL EDUCATION FROM 1924 TO 1947

The focus now shifts to the developments that occurred between the Wars, as well as on the creation of structure and the demarcation of the work undertaken by the Trades Schools, the Technical Colleges and the High School Divisions established at some of the Technical Colleges. The developments directed the financial relations existing between the Union government and the provinces, leading to investigations being undertaken into the subsidy structure. The large number of commissions and committees that were established will be explored, especially regarding the issues relating to the context of technical education, the pretensions to university status exhibited by the technical colleges, and the establishment of the level at which technical education should be offered.

### 2.4.1 The university aspirations of the technical colleges

However promising the growth of, and developments in, technical education appeared to be after World War I, the technical college sector was around 1927 threatened by a new focus on the existence of a number of overlapping functions. At the time, the Natal Technical College wanted to offer Durban-based technology degree courses, which, according to the DoE, more appropriately should have been handled by the University College in Pietermaritzburg (Rees, 1957). The attempts made by the Natal Technical College to provide such courses led to the belief that it wished to act as a university (Rees, 1957), resulting in a crisis of identity being experienced by the college sector.

The extent of the crisis grew and "...in the mid-twenties, opinion in Parliament, and in the Department of Education, hardened against any further increase in the number of South African universities or university colleges" (Rees, 1957:188). The head of the Natal Technical College wrote to the Minister of Education, but it was pointed out that the Minister had already in 1924 indicated that no additional university would be founded within the Union.

Instead, it was felt that the technological and commerce degree work done by the college should be developed (Rees, 1957).



The Minister further supported the development of the technical college. Natal was found to have "...a first class technical institution in Durban, and I have told them the municipality of Durban will give its utmost assistance to that institution..." (Rees, 1957:185). Malan neither encouraged the establishment of a university college, nor that of a university, in Durban, due to his understanding that Durban was a key industrial centre, which would logically serve as an appropriate centre for the development of industrial education (Rees, 1957).

Malan's reaction was understandable, given the prevailing circumstances. As already mentioned, Durban, together with Cape Town, served as one of the sites that naturally developed into an industrial growth point, because of the entrance into the country of British immigrants via the ports. Malan realised that the creation of a situation in which the development of educational facilities might challenge otherwise potentially healthy industrial growth in the region was undesirable. Despite his misgivings, the educational concerns of the time still led to the appointment of the Van der Horst Commission in 1926, aimed at investigating the issue of overlapping functions, including the taking of a fresh look at the functions of universities *vis-à-vis* those of technical colleges.

#### 2.4.2 The Van der Horst Commission

As part of its investigation, the Van der Horst Commission considered the issues of divided control and the expense of work being duplicated in the different types of institutions (Pittendrigh, 1988; Rees, 1957). The Commission's report was published in 1928. The Commission's work was certainly an initial contributor to increased public awareness of the two distinct types of educational institutions present at the time in South Africa. In this regard, two findings of the report were of especial importance. The first related to the preliminary observation made in the report as to what, in fact, underlay the inquiry: "The questions to which the Commission has sought an answer hinge upon the conception of the purpose of Universities and Technical Colleges in the national life" (Van der Horst *et al*, 1928:7, 8). The Commission referred, in this regard, to the issues of financial relations and control. The Commission maintained that the control of education was divided between the provinces and the Union purely due to the financial considerations concerned. The Commission found that the existing problems could only be solved if the fundamental question of the aims and purposes of education were to be addressed.



The second point referred to the educational framework as conceptualised by the Jagger Provincial Administration Commission in 1917, which had led to difficulties in the positioning of technical education. We "...have heard and read a great deal about the various kinds of education – primary, secondary, higher – cultural, vocational – professional, technical – and we have found in frequent use expressions like 'general education with a vocational bias' and 'cultural education with a technical bias'" (Van der Horst *et al.*, 1928:7, 8).

The positioning of technical education between secondary and higher education created difficulties for the Commission. Not only did it make the standing of technical education problematic, but it also problematised the identification of a logical framework in which to position technical education.

The Natal University College was involved in the investigation undertaken by the Van der Horst Commission. The Natal Technical College was disappointed when it was informed that the view of the university college differed extensively, point by point, from the college view (Rees, 1957). The views of the Natal University College, therefore, did not actively contribute to the development of the technical college sector. The Natal Technical College maintained that the pure science part of a technology degree might be offered by a university in centres that possessed both a university and a technical college. The college was of the opinion that the applied work should, in such cases, be undertaken by the College (Rees, 1957).

The recommendations of the Van der Horst Commission dealt mostly with how to link the colleges concerned more closely to the provision of secondary school work (Pittendrigh, 1988; Rees, 1957). According to the Commission, if the stages of education were "...divided [into]...stages of...primary, secondary, and higher [education]...the pupils at the Technical Colleges are mostly at the beginning of the second stage in entrance" (Rees, 1957:198, 207). The Commission also criticised the Union Government, saying that the Government "has...taken over a branch of secondary education and dubbed it higher education" (Van der Horst *et al.*, 1928:11).

This view by the Commission detrimentally impacted on the development of technical higher education in South Africa. Rees wrote that the Commission had "...solved the problem of overlapping functions...by the simple expedient of recommending the down-grading of the colleges.

The motivation for this step was, if technical colleges became 'schools' offering a specialised type of secondary education, there would be no need to devise any formula to regulate the co-ordination of their activities with those of the universities" (Rees, 1957:198, 207–208).

Other than the Van der Horst Commission, the period from 1928, when the Vocational Education Act No. 29 was promulgated, to 1947 was characterised by a proliferation of various commissions and committees aimed at investigating a number of different educational issues. While the Roos and Adamson Commissions investigated the issue of financial relations in 1933, other commissions/committees were the 1939 Nichol Commission in the Transvaal, the 1940 Eybers Committee and the 1946 Wilkes Commission in Natal (Pittendrigh, 1988:135). The impact of the work undertaken by the Roos and Adamson Commissions, as well as by the Eybers Committee, is discussed in greater detail later on in this thesis.

The unpopularity of the Van der Horst Commission was mainly due to the manner in which it attempted to solve the problem of overlapping functions, as well as to its recommendation that the work undertaken by the technical colleges should be positioned at the secondary level. These recommendations by the Van der Horst Commission made the Association of Technical Colleges aware that they needed to play a much more prominent role in the debates on the nature of as well as the level at which technical education provided by the colleges should be offered. We noted that these efforts of the Association led to the establishment of Colleges for Advanced Technical Education in the 1960s and this action taken by the Association can be interpreted as an early demonstration of the desire of the Association to securely pitch vocational/technical education at the tertiary and eventually higher education level.

#### 2.4.3 The involvement of the Association of Technical Colleges

Right from the outset of technical colleges, the colleges embarked on informal contact with one another, which led to the establishment of an Association of Technical Colleges in 1926. The Association was patterned on the British example, with the adoption of a constitution at its first meeting (Lurie, 2000:34; Pittendrigh, 1988:121,122).

The following technical colleges were, at that time, members of the Association:

- the Cape Technical College;
- the Bloemfontein Technical College;
- the East London Technical College;
- the Natal Technical College;
- the Pietermaritzburg Technical College;
- the Port Elizabeth Technical College; and
- the Pretoria and the Witwatersrand Colleges (Pittendrigh, 1988:122).

The Association almost inevitably became involved in the investigation into the 'overlapping of functions', when the Van der Horst Commission (or the University Commission, as it became known) was appointed (Pittendrigh, 1988:122). Technical College officials believed that the Commission was misled by the "...amount of elementary work which was being performed by the Colleges..." (Rees, 1957:208). Due to the Apprenticeship Act, a large number of apprentices starting to attend classes in the various colleges were obliged to begin at an elementary level. Technical College officials also maintained that technical colleges differed from secondary schools in their origin, aim and method (Rees, 1957:208).

The Van der Horst report "...provoked widespread resentment in technical college circles..." (Rees, 1957:207), which led to the rejection of the report by college officials. Not surprisingly, the technical colleges were, therefore, relieved when the Minister of Education gave "...assurances to Technical Colleges and Universities that he would take no action on the Van der Horst Commission's Report without prior consultation..." (Rees, 1957:208).

In spite of the assurances given by the Minister of Education, the Van der Horst Commission contributed to the crisis in which the technical education sector found itself by its endeavouring to position itself in higher education, as well as to rid itself of the inferior image from which it suffered. As a result, the Minister of Education organised yet another conference, at which technical education matters could be reviewed.

Representatives from the university section in Cape Town were invited to the conference in January 1929 and, in July of the same year, representatives of the Technical Colleges were invited to attend a similar conference.

The representatives at the conference "...held the view that...they should be permitted to meet every reasonable demand for adult education in the country" (Rees, 1957:203). They could, for example, see no good reason why they should not provide higher education...of a non-degree character" (Rees, 1957:203).

Such a proposal was largely instrumental in the consequent introduction of the diploma qualification structure at technikons. Participants in the conference agreed that the technical college sector would continue to be responsible for organising technical education on the secondary level, but that this should not be its only point of focus (Rees, 1957:210).

Unfortunately, in spite of a number of meetings held between the universities and the Association of Technical Colleges, little agreement could be reached either on the status of the Technical Colleges, or on the apparent overlap in functions experienced by the technical colleges and universities (Pittendrigh, 1988:124).

#### 2.4.4 Financial relations between the Union government and the provinces

The unresolved issue of the overlap in functions between the technical colleges and universities and the many unsuccessful attempts made to position technical college education appropriately adversely affected the existing financial relations between the Union government and the provincial administrations concerned.

Furthermore, the Wall Street crash in 1929 not only affected South Africa as a whole, but also the availability of state funding for education. The "...economy of the Union had been shaken by the convulsions in world finance capitalism..." that started with the Wall Street crash of 1929 (Rees, 1957:215). Technical colleges were also affected, so that, as "...usual in times of financial stringency, Government expenditure on higher education was being closely scrutinised" (Pittendrigh, 1988:125).

The Roos Commission was appointed in July 1933 to launch a new investigation into the financial relations existing between the Union and the provinces (Pittendrigh, 1988:125). In addition, the Adamson Committee was appointed in the following year specifically to look into the matter of the granting of subsidies to technical colleges. Such a development was partly due to the problems arising from the 1922 formulae, which had added to the unstable financial relations

already existing between the Government, universities and technical colleges (Pittendrigh, 1988:125; Rees, 1957:215).

Finally, in 1934, the Minister advised the technical colleges that, while he accepted the subsidy calculations devised in terms of the Adamson Committee's recommendations, he did not accept the formulae proposed by the Committee. The Committee's recommendation that subsidies be frozen (*Hansard*, 1934:4873 in Pittendrigh, 1988:128) was implemented, with the subsidies from 1931 to 1936 being accordingly affected. According to Pittendrigh (1988:128), "The consequent shortage of funds over a six year period had a stultifying effect on the development of the colleges."

When the new subsidies were announced for the three-year period commencing in 1937, certain irregularities were identified by the Association of Technical Colleges. The announcement of the new subsidies led to a deputation being sent by the Association to the Minister. Such a move yet once again led to the appointment of another committee of inquiry under the leadership of Dr Spencer, a former inspector of technical education under the London County Council. This time the Committee made much more favourable recommendations, resulting in a new formula being devised, which would, in this case, apply until 1964.

#### 2.4.5 Centralised organisation of technical training

On the Union's entering the Second World War that broke out in 1939, the Government implemented a policy requiring apprentices to continue working in their various trades rather than enlisting (Association of Technical Colleges, Presidential Address, 1947:1 in Pittendrigh, 1988:129). The main reason for this policy was that the Union needed 20 000 technicians to keep production at the level required by the country for war purposes (Pittendrigh, 1988:130).

During the early years of the war, a decision was taken to open technical training centres at each institution to offer classes in subjects such as fitting, turning, machining, woodworking, welding, blacksmithing and sheet metalworking (Rees, 1957:245, 246). The loyalty pledged to the war effort by the college sector contributed to the central organisation of technical training (COTT) (Pittendrigh, 1988:131). Such training led to the discovery of "...the effectiveness of well planned intensive training for specific purposes" (Pittendrigh, 1988:131). After undergoing a substantial number of changes, the aims of COTT training resulted

in the decision that "...in future all apprentices should follow a compulsory COTT basic training" (Pittendrigh, 1988:131).

Although the taking of such a decision was strongly opposed by the technical colleges, with its being followed by another long period during which no further developments took place (Pittendrigh, 1988:132), COTT training could, in fact, be regarded as the forerunner of formalised technical education.

#### 2.4.6 The Eybers Committee

Due to the unclear lines of division existing between the functions of the technical colleges and universities, the issue of overlapping concerns was once again investigated in 1940. A committee, acting on behalf of the DoE, appointed an inter-departmental committee under the chairmanship of Dr G.W. Eybers. The latter committee was responsible for looking into demarcating the work of technical colleges, trade schools and high schools (Pittendrigh, 1988:135).

The committee reported that it was in favour of vocational education "...not commencing before the age of 14 years..." (Pittendrigh, 1988:136). The report of the committee, which was duly accepted by the Minister concerned, contained the very important recommendation that all post-standard 8 work should be offered by technical colleges (Pittendrigh, 1988:136).

A further development was the establishment of a Directorate of Demobilisation in 1944. The Directorate, as well as drafting a national plan for the training of ex-soldiers, also made provision for a comprehensive survey of employment possibilities (Pittendrigh, 1988:132). The outcome of the survey consequently undertaken classified the returning ex-soldiers into four classes, one of which consisted of a group of men who had been partially trained before the onset of the war and who had still to complete both their practical and theoretical training. The Directorate made provision for the technical colleges to undertake the theoretical side of the training of those who formed members of this class (Pittendrigh, 1988:133). Such a move served not only to ensure the survival, but also a new beginning, of the technical college sector.

#### 2.4.7 Further growth in the technical college sector

From 1924 to 1947, several new technical colleges were established.

In the Cape Province, technical colleges were established in East London and Port Elizabeth in 1925. In the same year, the Witwatersrand Technical Institute was declared a "place of Higher Education". One technical college was established in Pretoria in 1926 (Lurie, 2000:162), with another being established in Pietermaritzburg in 1926. Another promising development that took place at the post-apprenticeship level at that time was the "...opening of the Natal School of Pharmacy, the first of its kind in South Africa, in February 1926" (Rees, 1957:179). With this venture, it was once again the Natal Technical College that "...had pioneered a new development in vocational education in South Africa and its example was quickly followed by the Colleges in Cape Town and Johannesburg" (Rees, 1957:179).

Another development that took place in technical education in Natal was the establishment of the M L Sultan Technical College, which became the oldest historically black technikon, the M L Sultan Technikon. This technikon developed from technical classes, offered under the auspices of the Natal Indian Teachers' Society and the Natal Indian Workers' Congress in the late 1920s. Another historical black technikon, the Peninsula Technikon, had its origins in apprenticeship classes, offered to coloured apprentices by the Cape Technical College during the 1920s (Cooper & Subotzky, 2001:10). In the Orange Free State, a Technical College was established in Bloemfontein in 1931 (Lurie, 2000:16).

#### 2.4.8 The findings and recommendations of the De Villiers Commission on vocational education

The De Villiers Commission was appointed in March 1945 to investigate technical education. The main reasons, given for the appointment of the De Villiers Commission were the:

- unresolved issue of control over technical education;
- the ending of classes conducted during wartime;
- the slow progress of technical education in South Africa; and
- the overall state of technical and vocational Union education (De Villiers, 1949:ii; Pittendrigh, 1988:136; Rees, 1957:261).

The commission gave special attention to the following issues:

- the most suitable methods of training for industry and the role of apprenticeship in this training;



Some of the important findings of the Commission related to the serious limitations of the in-service and on-the-job training offered by various establishments and organisations at the time. The apprenticeship system of training still formed an important method of training aimed at addressing the demand for skilled artisans experienced then.

The Commission (De Villiers, 1949:277) found the following:

- The system of apprenticeship training urgently needed revision.
- The relationship between general and vocational education was inadequate.
- Adequate articulation and co-ordination was lacking.
- The functions of the different institutions seriously overlapped.

The findings of the De Villiers Commission differed very little from those of the debate waged during the second and third periods under discussion in regard to issues relating to technical education. The similarity of the issues addressed by Snape, as well as those highlighted by the Van der Horst Commission, consequently can be seen to have been essentially those same issues that had shaped technical education in South Africa from 1910 to 1947, comprising the years from the establishment of the Union to just before the National Party took over control of the country. The context in which technical education was provided thus came to replace technical educational needs, the focus of the earliest years, as a provider of sufficient momentum for developments to proceed in a certain direction.

A committee, appointed by the Department of Labour and following up on the work of the De Villiers Commission, brought about reconsideration of, and consequent changes in, the conditions of employment of apprentices in certain trades. Such changes affected the system of "...instruction at the technical colleges, which...represented an important modification of the old system of training" (Rees, 1957:263). The modified method of instruction at the technical colleges was not the first time in the history of technical education that industrial developments impacted on developments. Earlier on, the Apprenticeship Act also had had an impact on the manner in which technical education was organised.



Regarding vocational training, "...the [De Villiers] Report called for the appointment of a National Advisory Board whose first task ought to be a survey of the vocational needs of South Africa..." (Rees, 1957:263). The resulting survey conducted by the Board led to the publication of a new philosophy statement on vocational education, which referred to specific aspects of vocational education, namely "...homemaking, commercial, technical and industrial, apprenticeship training as well as advanced and part-time vocational education" (Pittendrigh, 1988:142). As a result of the De Villiers Report, a National Council for Education and a new national system of education were established under the DoE (Pittendrigh, 1988:143; Rees, 1957:263).

#### 2.4.9 Concluding remarks

The main focus during the period under discussion related to the minimising of the overlapping of functions performed by the technical colleges and universities – a concern for which no easy solution existed. Vested interests in both sectors made it difficult to resolve such “overlaps”. Such lack of consensus regarding the demarcation of functions revealed a sector still struggling to find its rightful place in the educational landscape. The continuing debates on such matters – and the related discussions around financing – typify institutions lacking a clearly defined and well-established identity. Only after the conclusion of the Second World War – as is discussed below – would such matters be settled more definitively. The years, 1945 to 1947, were dominated by the investigation and recommendations of the De Villiers Commission regarding vocational education in South Africa. The findings of the Commission once again demonstrated the close link existing at the time between South African political sentiments, industrial developments and technical education.

### 2.5 ADVANCED TECHNICAL EDUCATION FROM 1948 TO 1978

The discussion of the period from 1948 to 1978, ending with the establishment of the CATEs, explored the developments resulting from the involvement of the Department that led to improvements in the system of apprenticeship as well as the efforts of the Association of Technical Colleges to firmly establish the CATES as providers of education at the tertiary level, with the differentiation between vocational education at the secondary level and technical education at the higher education level becoming more defined.

I highlight how clarification was reached on secondary vocational and tertiary technical education; the structure given to the educational system by the Vocational Education Act, No. 70 of 1955; the progress made in the shaping of advanced technical education; and the establishment, in 1967, of the first four CATEs. The investigation of the Goode Commission, which positively impacted on the development of advanced technical education, and the earliest research developments also receive attention.

In spite of the processes outlined above, we note that the technikons, which I discuss in the next section of the chapter, for the greater part of their existence appropriated the term vocational to the type of education the technikons provided, almost indicating some kind of intrinsic confusion in terms of the future mission of the sector, i.e. should it be vocational or a mix of vocational and technical. What is not clear from the intentions of the Association and later the Committee of Technikon Principals, is whether they ever meant that the three-year diploma programmes that became the bulk of the qualifications the sector offered, should be vocational in nature, and whether the advanced programmes they were to conceptualise were to be technical in nature. This raises the question whether the concept “technical” became a vehicle for the sector to offer degree qualifications especially as the issue of the institutions becoming technological colleges entered the debate.

### 2.5.1 Reactions to the De Villiers Commission's recommendations

The De Villiers Commission was mandated by the United Party. The parliamentary election in 1948 led to the National Party government coming to power (Pittendrigh, 1988). As a result of the change in government, the findings of the Commission did not receive much attention, which “...was extremely regrettable as the Report represented an intensive study of the educational system in the post-war period...” (Pittendrigh, 1988:143). However, although implementation of recommendations made by the De Villiers Commission posed a considerable challenge, the report led to the revision of the technical syllabi and to increased recognition of the advanced technical courses offered by technical colleges (Pittendrigh, 1988).

In addition, “...a memorandum had been placed before the Cabinet advocating the transfer of the technical and commercial high school sections of the technical

colleges to the Department" (Pittendrigh, 1988:145, 146). This development was a significant step forward in the field of technical higher education.

In 1951, the technical colleges reacted to the report of the De Villiers Commission, proposing the transfer of the commercial and technical high schools to the State. Finally, an agreement was reached "...on commercial education so that commercial high schools and technical colleges would only offer courses for standards nine and ten..." (Pittendrigh, 1988:146). Unfortunately, the agreement did not solve the problems concerning divided control of secondary vocational education. The persistence of the technical colleges that they should retain their technical high school apportionment was also a setback for the development of tertiary vocational education (Pittendrigh, 1988).

The Department of Labour started to play a bigger role during this period. In 1950, the Minister of Labour appointed another committee to study the De Villiers Report, in order to obtain some clarification on how to propose an appropriate way forward for the apprenticeship system (Pittendrigh, 1988). The profound impact of the study could be seen in two proposed improvements that were effected with the promulgation of the Apprenticeship Amendment Act No 28 of 1951. The improvements were the introduction of a one-year full-time pre-apprenticeship course in the technical high school divisions of technical colleges, as well as the introduction of qualifying trade tests (Pittendrigh, 1988).

## 2.5.2 Relations between the Association and the Education Department

In the latter part of 1940, the Association of Technical Colleges became concerned about whether the Councils of Technical Colleges would retain sufficient autonomy to enable them to manage their respective institutions. The friction resulting from the desire of the technical colleges to retain their autonomy continued into the 1950s (Pittendrigh, 1988).

Finally, in 1954, after a meeting between the Minister and the Secretary for Education, a Financial Fact-Finding Committee was appointed in the Union. This committee aimed at improving existing relations between the Association and the Department. The Committee reported on its work to the Department in October 1954.

The report contained the recommendation that the Cabinet should take over all technical colleges as full state institutions (Natal College Minutes, 1954:10073 in Pittendrigh, 1988).

The two most important reasons for this decision were as follows:

- The transfer of the Technical Colleges to the State would contribute to the co-ordination of vocational education with the provincial education system, as well as with the university sub-system.
- The demarcation of the functions of each of the types of educational institutions functioning in the provinces was put forward as a reason for central control (Pittendrigh, 1988:148–149).

Up until that time, the differences between vocational and technical education had largely been underplayed. In 1954, one of the first true distinctions between vocational education and technical education was drawn, with the positioning of vocational education at secondary level and technical education at a more advanced level.

The technical colleges at that stage seemed unable clearly to discern their future role (Pittendrigh, 1988). At the time, the following ten colleges formed part of the Association of Technical Colleges in terms of the Higher Education Act, No. 30 of 1923: the Cape, East London, Natal, Northern Cape, Orange Free State, Pietermaritzburg, Port Elizabeth, Pretoria, M L Sultan and Witwatersrand Technical Colleges (Department of National Education, 1988).

In 1955, the Vocational Education Act No. 70 was passed, which provided for "...the transfer of the maintenance, management and control of declared institutions - in other words technical colleges - and State-aided vocational schools to the Government" (Department of National Education, 1988:6). When the Bill was read for the second time in Parliament in June 1955, the Minister stated that one of the aims of the Bill was to supply a "...clearer definition of vocational education than has been the case up to the present" (House of Assembly Debates, 1955 quoted in Pittendrigh, 1988:15). The Act empowered the Minister of Education, Arts and Science to terminate the powers of the existing college councils (Vocational Education Act, No. 70 of 1955:1696).

From 1956 onwards, the first colleges were managed according to the arrangement set out in the Vocational Education Act.

Between 1959 and 1963, the last technical colleges were taken over by the Government, consisting of the Free State, East London, Port Elizabeth and Pietermaritzburg Colleges. The Cape, M L Sultan, Natal, Pretoria and Witwatersrand Colleges were not taken over by the DoE during that period (Pittendrigh, 1988).

The Vocational Education Act made provision for the recognition by the Minister of courses at higher education level, satisfying the needs of those students who were subject to compulsory school attendance. A provision was made, however, that such courses should not be offered by an institution that was controlled by the provincial administration. (Vocational Education Act, No. 70 of 1955). The Act also described the powers of the Minister with regard to higher education and continuation classes (Vocational Education Act, No. 70 of 1955).

During that time, the role of the Association of Technical Colleges was mainly to act as a forum for discussions on matters of common interest to the colleges and as a vehicle for submissions to the Minister of Education, the DoE or any other relevant departments or outside bodies.

In 1959, the Association started to compile memoranda on issues such as the status of the technical colleges. These memoranda were presented by the Association to the Secretary for Education at a meeting in 1960. The meeting between the Association and the Secretary for Education introduced a new period in advanced technical education, mainly due to the Department's indicating during the meeting that it wanted to "...separate...secondary education from advanced post-matriculation education..." (Pittendrigh, 1988:162). This outcome was largely responsible for the rapid advances in technical education that took place during the next few years. Such progress included the establishment of the technicians' course in 1956; the approval of the NHD in 1963; the raised entrance requirements for studies undertaken at the technical colleges from 1967 onwards; and the first steps taken towards the establishment of the CATES.

### 2.5.3 Advanced technical education developments

The provision of the Vocational Education Act led the way for the first developments in advanced technical education, of which the first prominent one was the development of a technicians' course in 1956 (Pittendrigh, 1988).

This course was aimed at addressing the gap identified in the occupational structure, as well as the shortage of technically trained workers required to supply the need for workers on a rung midway between that of engineer and artisan in the labour force (Pittendrigh, 1988). In 1957 the Department suggested that this rung could appropriately be filled by qualified technicians (Pittendrigh, 1988).

The technicians' courses that arose as a result later became known as sandwich courses, because of the way in which they were structured (Pittendrigh, 1988). The sandwich courses were a positive step in the direction of the development of technical education, with their implementation being "...heralded a period of healthy expansion of advanced technical courses..." (Pittendrigh, 1988:157). In February 1957, the Department convened a meeting of employers. During the course of this meeting, the possibility of offering courses to technicians in electrical and mechanical engineering was discussed (Pittendrigh, 1988).

Participants in the employers' meeting resolved to send out a questionnaire to all "industrial concerns in South Africa", aimed at defining the true nature of an engineering team as consisting of a professional engineer, an engineering technologist and a technician. The outcome of the survey was that technical training was positioned at the level of the technical colleges, with eleven technical colleges being identified as appropriate centres for training (Pittendrigh, 1988). These colleges had to immediately refrain from training at high school level.

The above development was only one of the many changes in post-secondary training taking place in the technical college sector from 1955 to 1967. The reasons for the changes were mostly that the college buildings were no longer occupied by "high school pupils" during the day. The sector also wanted to respond to the growing need expressed by industry for trained technical human resources (Pittendrigh, 1988).

Two significant developments that contributed to advanced technical education took place in 1963. The first was the decision to "...introduce National Higher Diploma courses on a part-time basis for holders of the four-year sandwich course diploma in the study areas of electrical, mechanical and radio engineering" (Pittendrigh, 1988:157). The sandwich courses consisted of three years theoretical training, interspersed by two periods of six months' practical training. The second development "... was the decision...that the courses would

be converted from Standard Eight entry to post-Standard Ten courses with effect from 1967" (Pittendrigh, 1988:157).

Advanced technical education continued to develop during these years. Debates regarding the nomenclature and characteristics of advanced technical education continued to take place, eventually leading to the implementation of the recommendations made by the Goode Committee.

The consequent attention given to the status of the larger technical colleges led to a fresh look being taken at the role of the Association of Technical Colleges. The Association maintained that its future role would be to function on behalf of the larger colleges, since they had requested to remain autonomous in order to "...perform their growing advanced technical education function..." (Pittendrigh, 1988:163). During the latter part of 1963, the request for autonomy made by the technical colleges was turned down by the Minister (Pittendrigh, 1988). As a result, the East London, Northern Cape, Orange Free State, Pietermaritzburg and Port Elizabeth colleges no longer formed part of the Association (Pittendrigh, 1988).

However, in 1964, the DoE had an apparent 'change of heart' regarding the transfer of the technical colleges to State control. This rethinking of the situation may have been the result of the outcome of the Schumann Commission into the Financial Relations existing between the central government and the provinces, as well as the report of Prof Mönnig on the organisation of science (Pittendrigh, 1988:164). The Schumann report strongly recommended that especially the larger and more stable technical colleges should rid themselves of their involvement at trades level, so that they could rather focus on work just above this level, at the medium or above-medium level. The colleges to which the Schuman report referred included the colleges in Johannesburg, Durban, Cape Town, Pretoria and Port Elizabeth.

The report added that the education provided by these colleges could later be incorporated into the technological education provided by universities. Especially the engineering courses were earmarked for this conversion to degree courses (Pittendrigh, 1988:164; Schumann, 1964:44).

The Mönnig report, published in 1964, contained a number of recommendations regarding technical colleges and universities.



The main consideration of this report was that technical colleges and universities, as training facilities, did not provide sufficient variety to cater for all the technology education needs being experienced at the time (Mönnig, 1964; Pittendrigh, 1988). In certain other countries, such as Australia and New Zealand, "...they were planning technological colleges at a level between the technical college and the university" (Pittendrigh, 1988:165). Mönnig's report concluded that consideration should be given to raising the four most advanced South African technical colleges to the level of the technological colleges (Pittendrigh, 1988). The Pretoria, Johannesburg, Durban and Cape Town technical colleges, which fell into this group, were granted permission in 1964 to continue as autonomous institutions empowered to offer advanced technical and teacher training (Pittendrigh, 1988). The Port Elizabeth College, earlier identified by Mönnig, was not, however, included in this group.

The outcome of especially the Mönnig report represented a turning point in the history of the technical college sector. The sector was at a point where technical colleges had to decide their future role in advanced technical education, with the result that college officials had to choose the name that would most appropriately reflect the nature of the envisaged education offering of the future. The sector chose to bide by the name 'Colleges for Advanced Technical Education' rather than that of 'technological colleges', as was recommended.

#### 2.5.4 The CATES

The Advanced Technical Education Act No. 40 of 1967 (628) stipulated as follows: "The Cape Technical College, Natal Technical College, Pretoria Technical College and Witwatersrand Technical College declared to be places of higher education under the Higher Education Act, 1923...shall, as from the date of commencement of this Act and under their respective designations, be deemed to be colleges for advanced technical education...". In this way, the four colleges concerned were granted the status of advanced technical colleges in 1968 (Department of National Education, 1988:6).

The acceptance of the name 'colleges for advanced technical education' led to a draft Bill being submitted to all colleges concerned in September 1965, as well as being submitted to Parliament in September 1966.



As the Bill did not immediately come up for consideration by Parliament, the Association was given the opportunity to propose amendments pertaining, *inter alia*, its own status. Few of the amendments were, indeed, attended to and, in 1967, with the publication of the Draft Advanced Technical Education Bill in time for the 1967 Parliamentary session, the period of uncertainty for the larger colleges finally came to an end (Pittendrigh, 1988).

The Advanced Technical Education Act made provision for the State President to "...declare any institution recognized as a State-aided vocational school under section 6(1) of the Vocational Education Act, 1955...to be a college for advanced technical education" (Advanced Technical Education Act, No. 40 of 1967:630). As a result, the "...Association of Technical Colleges became known as the Association of CATES..." when the Advanced Technical Education Act was passed in 1967. The Vaal Triangle and Port Elizabeth Colleges for Advanced Technical Education were then added to the group of CATES (Goode *et al.*, 1978:11).

In addition to the first four technical colleges becoming the first CATES, the apprenticeship classes, which had been offered to coloured people by the Cape Technical College during the 1920s, were incorporated into the offerings of the Peninsula Technical College, established in 1962. In 1972 this college became the Peninsula College for Advanced Technical Education. The technical classes offered to Indians in Natal during the 1920s also served as the basis for the founding of the M L Sultan College for Advanced Technical Education for people of Indian descent in 1969 (Cooper & Subotzky, 2001).

With the promulgation of the Advanced Technical Education Act in 1967, a significant technikon research development took place as regards the advancement of technical education and technical colleges. The Act in question extended the qualification structure and raised the entrance requirements to such institutions (Pittendrigh, 1988; Steyl, 1989). According to Beukes (1984), consideration was given to the involvement of both staff and students in research with the establishment of the CATES.

According to Pittendrigh (1988), some aspects that were clarified regarding the future role of CATES were the following:

- The colleges would confine themselves mainly to advanced technical and teacher training, expanding to a level somewhat lower than university level in both fields.
- The training provided by the colleges would be more practical than the corresponding university training in the fields concerned.
- The colleges would not develop into technological universities.
- Though research would be conducted by the staff at the institutions concerned, no research conducted by students would lead to the awarding of higher qualifications.

In Section Two of the Advanced Technical Education Act No. 40 of 1967, the National Education Department elaborated on the function of the colleges as the providers of "...advanced technical education and training" (Department of National Education, 1988:2). The outstanding characteristics of advanced technical education, as conceptualised at the time, deserve special attention.

Firstly, the absence of student research leading to higher qualifications was of special significance. This seems to have been an incorrect direction for the sector to have taken at the time, as it helped lead to a serious lack of development of technologically skilled human resources needed by the country at that stage, as well as detrimentally affecting the sector's ability to respond adequately to changes taking place in the economy of the time.

The step also served to slow down the overall research development of the sector in comparison with the contemporaneous advances made by the universities. The outlook held during this period came to be seen as largely leading to the research 'backlogs' to which the Committee of Technikon Principals so continuously referred during the 1980s. Such research backlogs were largely due to the non-involvement of students in research at the time. In addition, the level of research activity of initially CATE and later technikon staff was insufficient to contribute meaningfully to the initial establishment of the colleges, first, as tertiary education providers and, later, as providers of higher education.

Secondly, the issue of whether or not the colleges should become technological universities should be noted.

Pittendrigh (1988:184) wrote, "By virtue of its nature and function a C.A.T.E. is not a university and would not be transformed into one merely by being called a university."

The practical nature of advanced technical education indicated an approach which concentrated on "...the application of knowledge...", rather than on the knowledge itself (Pittendrigh, 1988:184). This distinction later served as the basis for the taking of decisions regarding which courses or subjects should be offered by technikons, and which by universities, as well as strongly contributing to the establishment of the binary divide in South African higher education. It was found that "the main factor which should govern a decision regarding the appropriateness of a subject for university study is the possibility of approaching that subject through the consideration of fundamental principles rather than through the imparting of factual information or of techniques" (Pittendrigh, 1988:184).

The earlier-defined confinement of "...themselves to advanced technical and teacher training extending to a level somewhat lower than university level..." (Pittendrigh, 1988:185) also created the idea of horizontal barriers between these two types of institutions. This conceptualisation was investigated and reported upon by the Van Wyk de Vries Commission in 1974.

The Commission reported on the role of CATES as opposed to that of universities, with the most important outcome of the Commission being the determination that no "...ceiling should be placed on the work of the CATES..." (Pittendrigh, 1988:185). This outcome represented a major development in the history of the CATES and later in that of the technikons. According to Norris (1994:19), the "...purpose of Act 40 of 1967 was to create a new type of institution for higher education intermediate between a technical college and a university".

Though such a decision was supported by the Association, it nevertheless wanted the technikon sector also to have the authority of a degree-awarding institution. The association therefore proposed obtaining the assistance of a degree-awarding institution, such as UNISA (Pittendrigh, 1988).

### 2.5.5 Research developments

In spite of provision having been made for the introduction of research at the colleges concerned, the relationship between the Association of CATEs and the DoE regarding the issue of research at technikons tended to be rather erratic.

At about the same time, the sixth conference of the Federation of Societies of Professional Engineers took place from 8 to 10 August 1973. As a result of serious requests made by the Federation at this conference, the Goode Commission of Inquiry was appointed to "...investigate and report on the education, training, the utilization and status of the engineering technician in the Republic of South Africa" (Goode *et al.*, 1978:1).

The Goode Commission Report was subsequently presented to the Minister of National Education, Dr P.G.J. Koornhof, on 15 February 1978.

The submission of applications to the National DoE in 1975 for the colleges concerned to be empowered to offer Higher Diplomas, fourteen years after Departmental approval, was one of the first outcomes of the Goode Commission's investigation (Pittendrigh, 1988). All industry-related developments taking place at the time indicated a growing demand for higher qualifications. Attention clearly had to be paid to the qualification structure of the technical education sector (Pittendrigh, 1988).

The successful conclusion of the application process was marked by Ministerial approval, granted during an interview in October 1977, of the concept of the qualification concerned building from a three-year diploma to a five-year diploma in technology (Goode *et al.*, 1978; Pittendrigh, 1988). Another breakthrough in the development of research at technikons was the "...acceptance of the concept that a technikon qualification could be obtained by means of research" (Pittendrigh, 1988:195).

In February 1977, the Minister of Education held a meeting with the CATEs, at which a number of decisions were taken, with the "...final matter referred to... [the Minister of Education being] ...that of research being conducted at CATES" (Pittendrigh, 1988:187).

A departmental research committee was then formed making funding available on an *ad hoc* basis for research, with effect from 1979 (Pittendrigh, 1988).

Research financing developments steadily picked up momentum after this for the entire duration of the following period, lasting from 1979 to 1993.

Regarding the initial focus of research at technikons, the Department decided that research conducted at the technikons should focus on educational issues, especially in connection with the education and training function of the institutions concerned. Research, therefore, was to be aimed at improving the ability of the sector to provide advanced technical education and, for this reason, was closely related to the structuring of qualifications on a higher level than that of the national diplomas that had been issued up until then.

#### 2.5.6 Concluding remarks

The pivotal event of the late 1960s undoubtedly was the establishment of the first four CATEs. Their establishment was the culmination of a number of attempts, starting with the De Villiers Commission in 1945, embarked on in order to advance the cause of technical education. In addition, the Commission had contributed significantly to the process of demarcating the field of secondary vocational education in relation to that of tertiary technical education. The promulgation of the Vocational Education Act No. 70 of 1955 and the introduction of the technician's course in 1956 also made a substantial contribution to the development of advanced technical education. These events took place as the result of a gap identified in the occupational structure, as well as the need for technically trained workers to bridge the gap existing between the artisan and engineering levels in the labour force.

A significant development during this period was the introduction of the NHD in 1963, for diplomats of the four-year technician's diploma, as it was then officially known, that was offered at that stage in the electrical, mechanical and radio engineering fields. The subsequent work undertaken by the Goode Commission led to the extension of the qualification structure to include a fifth-year qualification in 1981, as well as to the introduction of research as an integral part of a technikon qualification.

The concepts 'technology education' and 'technological colleges' were mentioned for the first time during this period of the evolvement of the technical education mission. No explanation was, however, offered for this type of education or the nature of a technological college other than that these colleges would provide

education at a level between the technical colleges and the universities. We saw that the Association of Technical Colleges opted for the redesignation of the technical colleges as Colleges for Advanced Technical Education almost signaling an “unreadiness” to offer technology education. It was only when the CATES were redesignated as technikons that the concepts ‘technology’ and ‘technological education’ resurfaced. This almost indicated the sector’s acceptance of its role to offer “technical” education at the tertiary level, although the colleges were already accepted as providers of tertiary vocational education for quite some time. Had the technical colleges opted for a designation of technological colleges they may have been better prepared to play a stronger role in the vocational qualifications forming part of the new qualifications framework that was announced at the time of the completion of the thesis.

It is clear from the discussion that the CATES interpreted the permission given by the Department of Education to the sector to extend its qualification structure to advance the level of technical education offered, as a “green light” to introduce research. On the one hand the Department was adamant that advanced technical qualifications would not be obtained by means of research whereas the sector utilised the extended qualification structure as a vehicle to advance technical education by adding research to the curriculum.

## 2.6 TECHNIKON EDUCATION FROM 1979 TO 1993

A number of developments were considered major shapers of technical education since the inception of technikons. Such factors consisted of: the name change from ‘colleges for advanced technical education’ to ‘technikons’ in 1979; the establishment of the historically disadvantaged technikons in the 1970s and 1980s; the establishment and work of the CTP; and the contribution made by the Certification Council for Technikon Education regarding academic quality assurance.

The discussion also covers the factors shaping early technikon education, such as the development of the technikon instructional programme, the differences between technikon education and university education, the tertiary nature of technikon education and the practice and promotion of technology. The focus is also on the addition of research to the technikon education function, as well as on the developments in technikon research financing.

### 2.6.1 Institutional name change

A number of factors contributed to the desire to change the name of the 'colleges of advanced technical education'.

The first was the continued strong association of technikons with technical education and with the rising need to improve the public perception of what constituted advanced technical education (Pittendrigh, 1988). The general perception was also that the name was unduly long. Technical education offered by the CATES also continuously cultivated a "...close relationship with technical colleges...", which this encouraged the "...less informed public to view a technician as the modern name for an artisan" (Goode *et al.*, 1978:89). The desire was therefore for a name that "...should signify the advanced nature of the technical education and training offered..." by the CATES (Goode *et al.*, 1978:89).

As early as 1966, the Association of Technical Colleges was already busy with discussions regarding the possibility of changing the name of the institutions concerned to that of Colleges of Technology. In 1970, the Association not only considered changing the name, but also attended to the autonomy of the colleges, as well as to the amendment of the Advanced Technical Education Act No. 40 of 1967. The work done by the Goode Commission led to a number of resolutions, of which securing a more acceptable name for the sector was a priority (Pittendrigh, 1988).

After much debate regarding what would constitute an appropriate name for the sector, the first real progress was made in 1977. The Association considered a number of proposals in this regard (Pittendrigh, 1988), including that of the name *technion* (Goode *et al.*, 1978). The prevailing view was that this name possessed "...a novelty which could be turned to advantage in emphasizing the concept of this extended type of CATE education" (Pittendrigh, 1988:193). The DoE finally "...chose the word *tegnion* and referred the word to its language experts who then suggested the name *technicon* or *technikon*" (Pittendrigh, 1988:193).

The name of *tegnion* was accepted by the majority of college councils in existence at that stage, leading to the Cabinet announcement, in November 1978, of acceptance of the new name (Phillips, 1980; Pittendrigh, 1988).



However, with the promulgation of the Advanced Technical Education Amendment Act No. 43 of 1979, the name of the institutions concerned was changed to that of *Technikon*. By affixing the suffix "kon" to the Greek root word "techne" (referring to ingenuity, dexterity or skill), the adjective was changed into a noun, thus coining a uniquely South African term. The Colleges thereafter accordingly became known as technikons (<http://www.technikons.co.za/CTP.html>).

According to the Department of National Education (1988), the redesignation of the CATES in 1979 was significant. The name change from 'colleges for advanced technical education' to technikons was seen as a "...milestone in the development of the technikons" (Department of National Education, 1988:8). In terms of the Act, the Pretoria, Johannesburg, Durban and Cape Town Colleges for Advanced Technical Education became four of the first six technikons to develop in South Africa (Department of National Education, 1988:8).

#### 2.6.2 The establishment of the historically disadvantaged technikons

The establishment of the historically disadvantaged technikons – a term given to the group of technikons that made provision for advanced technical education to the African, Colored and Asian population of South Africa during the 1970s and 1980 – signifies a very specific era in South African history. The establishment of these technikons took place within the policy context of racial segregation and the establishment of homelands as part of the National Party-designed system of central governance and regional administrative system. From 1959 onwards, the government of the day established ten homelands, of which four (Transkei, Bophuthaswana, Ciskei and Venda) were treated, at least by the governing regime, as foreign republics (Tarp, 1992). The other six homelands created at the time were those of Gazankulu, Kangwane, KwaNdebele, KwaZulu, Lebowa and QwaQwa.

During this period there were 19 education departments, of which five catered for white learners, one for Asian learners, one for Coloured learners and eleven for African learners. A single umbrella education department set the norms and standards for the other departments (Tarp, 1992). Within this political framework development of the technikons for the separate racial groups transpired. As already mentioned, the M L Sultan Technikon, originating from the technical classes offered to members of the Indian population in the late 1920s, developed into the College for Advanced Technical Education in 1969.



The college was declared a technikon under the Advanced Technical Education Amendment Act No. 43 of 1979. The Act also led to the change in status of the Peninsula College for Advanced Technical Education, established in 1972, to that of a technikon. These two technikons thus became the first two historically black or disadvantaged technikons.

In addition to the first two technikons, which catered largely for the needs of members of the coloured and Indian population groups, five additional technikons were established in the former homelands during the 1970s as part of the "...self-governing homeland phase..." (Cooper & Subotzky, 2001:10). The Mangosuthu Technikon was established on the outskirts of Durban in 1979, while the former Technikon Northern Transvaal was likewise established on the outskirts of Pretoria in 1980. The Technikon Northern Transvaal evolved from the "technical colleges courses established for Africans in the 1960s under the Department of Education and Training in the Northern Transvaal" (Cooper & Subotzky, 2001:10). The establishment of the Mangosuthu Technikon resulted from the effort of the KwaZulu Mangosuthu Buthelezi combined with Anglo-American Corporation funding (Cooper & Subotzky, 2001).

This technikon, which was first established as the Technikon Mabopane East, was renamed the Technikon Northern Transvaal in 1985 and then, once again, renamed the Technikon Northern Gauteng in 1997 (<http://www.tng.ac.za>).

A further three former homeland technikons were established: In 1976, the Setlogelo Technikon, later renamed the Technikon North West, was established with Swiss financing in Bophuthatswana; The Transkei Technikon, later to be renamed the Eastern Cape Technikon, was established in Butterworth in 1987; The Ciskei Technikon, later to become the Border Technikon, was established near Bisho, in 1988 (Cooper & Subotzky, 2001).

### 2.6.3 The Committee of Technikon Principals

Soon after the establishment of the first four technikons, the Minister noted that the DoE had to deal directly with technikon officials in all matters which they wished to raise with the State. He therefore asked that the technikons consider the establishment of a body similar to that of the University Advisory Council.

The function of the new body would be to act as a buffer between the technikons and the department (Pittendrigh, 1988). The Minister felt that the name 'Association' was inappropriate, given the educational context, and that a Committee of Technikon Directors should be established (Pittendrigh, 1988).

The Association used this opportunity to propose a number of changes to the Advanced Technical Education Act No. 40 of 1967, opting to change its name from that of an Association to that of a Committee of Technikon Principals, or, preferably, to establish a totally new body (Pittendrigh, 1988).

The proposal was accepted and included in the Advanced Technical Education Amendment Act No. 84 of 1983, resulting in the creation of the statutory CTP (Betz, 1984; Knoll, 1982; Pittendrigh, 1988).

#### 2.6.4 Technikon education in transformation

Technikons were, according to the CTP, originally established with the purpose of equipping learners with a technical career education enabling them to meet the demands of industry for skilled labour (Wiid, 1988). Technikons were already, by this stage, well-known providers of technical education, due to the exceptional way in which the sector had developed in South Africa (Beukes *et al.*, 1990) as an initially provider of training for, firstly, artisans, then technicians, and, finally, technologists and engineers.

However, the nature, scope and content of technical education offered by technikons since their inception in 1979 changed substantially during the 1980s and early 1990s. A contributing factor, according to the CTP, was the ever-increasing complexity of demands made by industry. Almost "...daily one hears...how important it is that a larger percentage of our tertiary student population should receive career-orientated education, and that they should be channeled towards the technikons. Various projects of manpower requirements substantiate these claims" (Steyl, 1989:5).

The significant developments that took place in the technikon sector during the 1980s and 1990s require due consideration in order to attain an understanding of the nature of transformation that took place during this period.

The following areas seem best to reflect the impact of the transformation process undergone:

- (a) the technikon instructional programmes
- (b) the co-existence of the technikon and the university
- (c) technikon tertiary education
- (d) The role and function of research in technikon education
- (e) Technikon research financing
- (f) The initial restructuring of technikon research funding
- (g) Academic quality assurance.

(a) The technikon instructional programmes

Essentially, technikon instructional programmes encompass the core of the nature of technikon education and display a number of distinctive features. The purpose of this discussion is to highlight the features of technikon instructional programmes that make technikon education unique and which, during the 1980s and 1990s, differentiated the sector from that of university education.

The characteristics of technikon instructional programmes discussed are the following:

- the vocational orientation of the programmes involved;
- the relation of the programmes to industry;
- the applied and technological nature of the programmes; and
- the specific nature of the technikon programmes versus the more generalised nature of university programmes.

Firstly, Pittendrigh (1988:318) links the vocational orientation of technikon education to the applied nature of the instructional programmes, requiring that the technikon instructional programme should not have "...the basic subject discipline characteristic of university study". The vocational nature of technikon programmes epitomised the difference between the technikon instructional programmes and those of universities (Pittendrigh, 1988).

The vocational orientation of technikon instructional programmes further meant that the programmes displayed an occupation-specific nature. This orientation was a requirement for technikon education during the 1980s (Department of National Education, 1988), which the department maintained during the 1990s. The specialisation of technikons in the field of vocational education meant that their programmes aimed to meet certain set vocational/industrial requirements (Department of National Education, 1993).

Since their occupation-specific nature was a requirement for technikon instructional programmes, the role of industry in the technikon programme design process was regarded as so important that it led to the collaborative co-ordination and development of courses offered (Pittendrigh, 1988). The Certification Council for Technikon Education (SERTEC) (2000) went as far as to say that all instructional programmes should be introduced only after a thorough evaluation of their market relevance and potential had been undertaken. SERTEC (2000:2) continued, "It is understood that industry should be given and should make use of the opportunity to make an input during the compilation of instructional programmes."

The involvement of industry in curriculum design is not the only reason for technikons to have remained in touch with industrial developments. The Department of National Education stressed the importance of technikons keeping in touch with industry in order to stay at the forefront of the latest technological developments (Department of National Education, 1993). Technikons can only remain up to date, and technikon programmes can only be occupationally applicable, if their students gain exposure to the latest technology during their training. This is one of the reasons why technikon education should, *per se*, receive substantial government subsidies, because it will demonstrate an advanced level of commitment to providing the country with technologically trained human resources.

The process of ensuring the vocational applicability of the technikon instructional programme by means of ongoing co-operation with industry demanded that technikons should stay true to their mission of providing vocational education by staying in touch with the needs of industry by giving them due consideration in terms of curriculum design. Such an evolution embodies the philosophy of co-operative education and the practice of experiential learning, as described. The philosophy of co-operative education refers to "...the joint presentation of the programme by the technikon and the industry for which the qualification is designed" (Department of National Education, 1988:48). The need for close collaboration between technikon staff and industry, therefore, cannot be sufficiently emphasised.

Experiential learning became a prominent feature of the technikon instructional programme, combined with industry co-operation, in order to ensure the

vocational applicability of technikon education. SERTEC emphasised the importance of experiential learning as one of the strategies to ensure this "The institution must have a policy document on experiential learning in which the general policy to be followed by the operational units at the institution, is clearly formulated" (SERTEC, 2000:34).

SERTEC also emphasised the necessity of contact between technikon staff and the vocational community, proposing that institutions should pay attention to institutional measures that would facilitate this (SERTEC, 2000).

The importance of the link between industry and technikon education highlighted another feature of the technikon instructional programme, namely that of technology education. The function of technikons to provide technology training meant that technikons were responsible for training technicians and technologists (Pittendrigh, 1988). The Association of Technikons added that this development contributed to relieving technikons of their responsibility for training apprentices (Phillips, 1980).

I return to this point to when the tertiary nature of technikon education is discussed, because it was exactly this issue that contributed to the challenge for the sector in regard to the need for substantiation of the tertiary nature of technikon education.

The Committee of Technikon Principals highlighted four characteristics of the technikon instructional programme. The first was that technikon instructional programmes should consist of a well-organised body of technological and occupational knowledge. Secondly, the programmes would be offered at tertiary level and, thirdly, the programmes would be offered in collaboration with a particular industry. Fourthly, the purpose of offering the programmes would be for students to obtain a technikon qualification (KTH:6 in Department of National Education, 1988). The logic of the third and fourth points has been elaborated on in the previous paragraphs. The CTP, however, up until this point in time had still failed to clarify the concept of technical tertiary education and no clear lines existed between vocational and technological education and training.

The Department of National Education (1988) referred to technology education provided by technikons as an instrument for contrasting technikon education with university education.

On the one hand, technikon education was found to be specific and focused on training in, as well as the practice of, technology and its development. On the other hand, university education was seen as general and focused on the training in, and practice of, science and research. The Department also referred to the primary aim of technology training as consisting of providing the country with middle-level and high-level manpower (Department of National Education, 1988).

This view of the department explains the relative importance attributed to developing the technician's course and, later on, the higher level courses after the identification of an appropriate gap in the occupational structure.

The nature, scope and content of technikon instructional programmes have been described as applied, career-oriented, specific and technological in orientation. Merely differentiating the technikons from the universities at this level of analysis was, however, regarded as insufficient. These different aspects of technikon education all impacted on the development of the systemic relationship existing between technikons and universities, which, for a long time, failed to be understood by the broader public and many roleplayers in the educational discourse at the time.

(b) The co-existence of the technikon and the university

The broader public found the tertiary education landscape relatively incomprehensible due to South African tertiary education for many years being characterised by the co-existence of two types of institutions – universities and technical colleges. In 1979, the technikons complicated the situation still further when entering the landscape, with the resulting need to differentiate between the role of the university and that of the technikon. Both the process of differentiation and the accompanying process of transformation that took place are discussed in terms of the following long-standing issues in regard to the development of technikons:

- the differences between the approach of the technikon and university;
- the relation between the two types of institutions; and
- the level of education provided by technikons.

The difference between university and technikon education was one of an academic approach versus an applied approach (Khotseng (1989) in Fourie, 1999).

Although the differences mentioned above were not seen as being inherently conflictual, such an interpretation led to difficulties in interpreting the systemic relationship of the two types of HEI. The CTP described this relationship as being "...complementary in terms of the supplying of high-level manpower" (KTH:9 in Department of National Education, 1988:22), highlighting that each type of institution should have its own distinctive functions and objectives in order to justify the co-existence of the two separate institutions.

The Department of National Education (1988:7) held the view that technikons should enjoy free vertical development, but with a different focus: "The technikon should no longer be seen as part of a pyramidal structure with the university at the apex. The university was still, however, regarded as the academic leader in education". The department (Department of National Education, 1988:4) maintained that a new subsystem should be established "...alongside the universities at the purely tertiary level in South African education".

The department, however, noted a point of tension between technikon and university education in terms of the level of instruction, as well as in terms of research and development. The department regarded the issue as sensitive, due to the possible competition existing in these two areas between the two distinct types of institutions involved (Department of National Education, 1988).

The co-existence of the university and technikon therefore appeared to be possible. However, in order to facilitate this co-existence, it became necessary to clarify the level at which technikon education operated. In addition to the issue of determining the level of technikon education in relation to that of university education, the necessity to clarify the tertiary nature of technikon education also related to the status of the CATES.

Although the Advanced Technical Education Act No. 40 of 1967 brought some semblance of order to the subsystem, the Act still failed to address the issue of the status of the colleges to the satisfaction of the sector involved (Department of National Education, 1988).

Although the Van Wyk de Vries report contributed to the lifting of the artificial ceiling placed on the work of the CATES and contributed to a new relationship between the university sector and the advanced colleges sector (Pittendrigh, 1988), the CATES were still seen as inferior to the universities in the sense that



the colleges had to slot in under the universities at the vertical level. Their highest academic level was still at that time considered to be more or less equal to that of a first degree, placing a 'ceiling' on the qualification structure concerned.

The above discussion shows that a number of positive contributions were made to change the general perception that the colleges were subordinate to universities and therefore, intended for those of less academic ability (Pittendrigh, 1988). The way was, therefore, paved for a period in which much more constructive thinking and planning on the technikons and their roles became possible (Department of National Education, 1988).

For the reasons referred to above, it is worthwhile to focus on the tertiary nature of technikon education. Although technikon officials stated, with relative ease, that technikon education was provided on a tertiary level, if the sector was to be publicly seen as "equal" to the universities, the elements that made technikon education tertiary had to be specified to avoid being questioned on the legitimacy of the level at which education was provided.

(c) Technikon tertiary education

A healthy debate regarding the tertiary nature of technikon education took place during the 1980s. The main aim of the debate was to convince critics that the level of technical instruction taking place at technikons was indeed tertiary and that technikons consequently had earned a place in the higher education landscape.

As already depicted, the tertiary nature of technikon has a rich history, starting with the development of the technical institutes, then the technical colleges and finally the CATES in 1967, adding to the history the progression of the technikon from being a mere provider of vocational training to artisans to becoming a more fully fledged provider of technical education. The discussion that follows contrasts the views of technikon officials with views held by other participants of the higher education discourse in order to show how the technikon sector was continuously challenged to provide clarity regarding its definition of the tertiary nature of the education provided by technikons. The challenges in terms of the type and level of education offered by the technikons remained part of the search of an education model not only to meet the growing technological human resource needs of the country, but also to meet the needs of a South Africa in



transformation and technikons through the process of restructuring South African higher education, discussed in Chapter Three, succeeded to position themselves as universities providing technological education.

The discussion that follows refers mainly to:

- the issues the technikons concerned raised as substantiation for their claim, namely the status accorded to the sector by the Act;
- the progression that took place from secondary-level vocational education to tertiary-level technical education; and
- the consequent provision of technicians and technologists by the sector.

Though the above issues were all sufficiently legitimate concerns, the key question was whether the successful resolution of such issues would serve clearly to conceptualise the true nature of tertiary technical education.

According to Wollfe (1981:2), the Association of Technikons explained the link between the tertiary nature of technikon education and the name assigned to the sector in 1979 in the following terms: "It was necessary to emphasise that the particular title was coined solely to describe an educational institution which is offering technical education in the Republic of South Africa at a tertiary level." Further, the Association stated that the technikons had received the required acknowledgement of their status as fully-fledged tertiary-level institutions: "Their important place in our educational system and their vital role in our national economy is now fully recognised..." (Knoll, 1982:1). Beukes (1984) also subscribed to the view that the technikons were at the time fully-fledged tertiary institutions, providing career-oriented courses on post-secondary level.

The challenge for the technikon sector was that it was still relatively young and had not yet had the appropriate opportunity to confirm its position as a provider of tertiary education. A number of views were expressed in an effort to motivate for the tertiary nature of technikon education. According to the CTP, the tertiary nature of education relates to the way in which such education teaches students to think as well as to apply the knowledge acquired, with both insight and understanding, to the social and cultural environment in which they function (Wiid, 1988:6).

After studying both international and national developments in technical education, Pittendrigh (1988:313) was of the view that "...it is possible to define the educational characteristics of the technikons as tertiary educational institutions."

The Department of National Education linked the tertiary nature of technikon education to the supply of middle- and high-level manpower. "Technikons have been established to provide tertiary education for middle and high level manpower in technology...in order to supply the labour market with people possessing particular skills and adequate technological and practical knowledge..." (DNE, 1991:2 in Fourie, 1999:19).

The CTP commented that, as a result of the "...evolutionary development of technikons from technical colleges to the CATE (1967) and eventually to the present technikons (1979)...technikons have never been properly positioned in the tertiary field with regard to other tertiary institutions" (Wiid, 1991:2). Consequently, "...the traditional culture of the technical college with all the imperfections of a tertiary institution was carried into the technikon system" (Wiid, 1991:2). With these words the CTP highlighted the necessity for the sector to start the transformation process from within in order to contribute to the acceptability of technikons as being true providers of tertiary education.

Such acceptability was especially necessary because, according to Cooper (1992:3), the term 'tertiary' presented problems when it was assigned. "It seems that the concept of institutions for tertiary level technical education...developed in a very *ad hoc* way in the mid/late 1960s. The question of tertiary level technical education, above the level of technical high schools but below the level of universities, was fuzzy..."

Cooper (1992:3) noted the seeming reluctance of the State, which was "...initially unwilling to create separate institutions for the training of groups such as 'technicians/technologists' above the level of artisans (technical high school) but below the level of professional engineers (university)".

In addition, another aspect relating to the importance of the acceptance of technikons as tertiary institutions was the place of the technikon sector in the higher education landscape.

As was earlier mentioned, the Van Wyk de Vries Commission took as its point of departure "...that the two types of institutions should not be in a hierarchic order, but should stand side by side" (Department of National Education, 1988:24).

The department proposed an active approach that had to be taken by the technikons in order to ensure that they assume their rightful position in higher education. "If a scientific approach *per se* were the best approach to any field or problem, then the technikon should be subordinate to the university, which is the true seat of science. This means that it is for technikons to show that there are other intellectual principles of ordering reality than merely the theoretical" (Department of National Education, 1988:24).

The above issues raised by technikon officials fail sufficiently to refine the concept of tertiary technikon education. The difficulty of providing a clear definition is understandable, given the way in which technikon education developed. The difficulty in conceptualising tertiary technikon education adequately was, however, not only due to error on the side of the technikon officials, but also related to the commonly accepted link between degree education and tertiary education. A positive contribution was made by the department when it saw fit to link the tertiary nature of technikon education with the supply of high level of human resources. In spite of the absence of a clear concept of tertiary technikon education, the sector succeeded in providing technicians, trained at national diploma level, and technologists, trained at the master's and laureatus diploma level.

The technological nature of technikon education as an aspect of the technikon's applied approach to education was highlighted and regularly discussed in connection with the relationship of the technikons with industries, the specific vocational orientation of technikons, the applied nature of technikon research, and, lastly, the necessity of providing the South African labour market with technicians and technologists. The technikon sector needed to clarify what it meant by the practice and promotion of technology as part of its ethos of technology education. Obtaining such clarification would not only contribute to a better understanding of the difference existing between the levels of education of the technician and a technologist, but also to a better understanding of the transformation of technikon education, as encompassing development in the role

of technikons on the continuum from the practice and promotion of technology to the transfer of technology.

Technology was described by the CTP as consisting of the process during which practical scientific knowledge or other knowledge is applied with the aim of solving a given practical problem (Wiid, 1988:7). Such a definition relates well to the applied nature and orientation that the technikons felt was one of the distinct differences in the approach of the universities and that of the technikons. The CTP would, later on, use this concept as a basis for the type of research to be conducted by the sector.

The Department of National Education (1988) described technology training as consisting of the promotion of technology by means of instruction, research and development and the rendering of services. As a result, it felt that such instruction must, of essence, lead to the development of more well-qualified technological human resources for the country as a whole. In order to achieve this, the "...technology programmes should be structured in such a way that the students are turned out with a knowledge of the field of application of their specific technology" (Department of National Education, 1988:30). The CTP also maintained that technology was to be promoted through teaching, research and development, and community service (Committee of Technikon Principals, 1994; Sonn, 1992).

It becomes clear from the above discourse by essentially the technikon principals that consensus had to be reached in the sector on the term "tertiary". The principals "developed" the concept of tertiary education, raising the level of the concept from post-secondary education offered to be inclusive of functions as the transfer of applied skills, the provision of higher-level skilled especially technological, human resources and eventually its function to offer technology education and the provision of technological human resources, all indicative of the "move" of the technikons into higher education, of which they then had no option but to introduce and develop research.

(d) The role and function of research in technikon education

As already mentioned, the work done by the Goode Commission was one of the main factors contributing to the growing appreciation of the role of research at technikons. One of the outcomes of the Commission's investigation was the

extension of the qualification structure, introduced in 1981. The Goode Commission recommended that the apprentice and technician courses be separated, and that the course structure include a fifth year, comprising a Diploma in Technology, as well as a sixth year, enabling a learner to become an Associate of the Institute of Technology. Such a qualification would be granted on the basis of the successful completion of a relevant thesis, project or design (Goode *et al.*, 1978; Pittendrigh, 1988).

The concept of research developed slowly in the technikon sector. The very first research developments included the establishment of an appreciation of the importance of the role of research in technikon education.

This appreciation developed into a seminar organised by the DoE in 1979, and the first state funding being awarded for research, as well as the compilation of a database of technikon-based research projects (Betz, 1984; Knoll, 1982; Loots, 1983; Pittendrigh, 1988).

From its earliest beginnings in this arena, research was seen as part of the higher level of instruction that could be provided by technikons. Regarding this, the Association of Technikons remarked, "The introduction of the Dip. Tech. Courses for the training of technologists ushered in a new era in the development of technikons..." (Knoll, 1982:8–9).

In the 1984, the CTP wrote, "Although technikons are in the stage of development as regards research, there are signs of an increasing awareness of the importance thereof for their education and training as well as personnel development programmes" (Van Rensburg, 1985:9). The value of research as part of advanced technical education was increasingly gaining in recognition.

One of the aspects of the envisaged role and function of research at technikons, was the development of staff along the road of vertical progression by means of the improvement of staff qualifications. Although the Committee of Technikon Principals acknowledged how relatively ill-equipped technikons were to conduct research at the time, they requested that "...the research potential existing at technikons...not be underestimated (Shippey, 1987:5). The CTP felt that the presence of research at technikons would enhance the image of the sector (Shippey, 1987:5).

In spite of the fact that the CTP wanted to stimulate development in the field of research, it stated clearly, "...there is a need to retain a sensible balance...to ensure that we do not intrude on the terrain of others, and that we do not overemphasise research to the detriment of our many essential tasks" (Shippey, 1987:5).

Such an attitude once again demonstrates that the official view was that the difference between universities and technikons had to be maintained, not only at the educational level, but also at the research level. The Department of National Education (1988) also indicated that the focus of research at technikons should be on enhancing its relationship with industry and on the development of staff and students.

(e) Technikon research financing

The funding of research at technikons could, for the larger part of their development, not really gain momentum. The main aspects of technikon research funding that were at the core of the debates were, firstly, the portion of the subsidy to be allocated to research and, secondly, the measuring of technikon research output. As will be shown in the following discussion, these two issues remained key during the period in which technikon research funding was restructured.

Up to 1978 the CATEs were financed by means of *ad hoc* grants (Department of National Education, 1989). In his parliamentary speech in 1981, referring to the 1978 grant made, the Minister of Education reported that the conservative amount of R100 000 was made available for practice-oriented research. This amount was meant to support the new advanced courses introduced at the technikon (Hansard, 31 August 1981 in Pittendrigh, 1988).

The next development in technikon research funding came about in the form of the improvement in the subsidy formula in 1978, which resulted in the subsidy being adjusted to include a wider variety of subsidisable components than in the past.

The formula was further adjusted during the 1982/1983 financial year, with the equivalent of full-time students being used as the subsidy parameter. In addition, the identification of subsidisable components was retained (Department of

National Education, 1989). The DNE referred to the SAPSE-110 report in this regard, indicating that the same three objectives, namely instruction, research and community service, would be used as the subsidisable components for technikon funding (Department of National Education, 1989).

The Association of Technikons expressed its satisfaction with the technikon research funding developments in the following words: "I am...pleased to report that the Department has provided funds on the 1982 estimates to the technikons, to enable members of staff to gain the necessary experience in conducting research projects" (Knoll, 1982:9).

In addition to the adjustment of the subsidy formulae, it became necessary to pay attention to the financing of research activities at technikons. In 1981, the CTP noted, the "...Department, in July 1980, submitted to the Association documents outlining the procedure that it proposed should be adopted in financing the research projects at Technikons..." (Wolffe, 1981:3, 4).

According to the Committee of Technikon Principals, the department suggested that technikons should use the same funding channels as those used by the universities when they applied to agencies for grants (Wolffe, 1981). In 1983, the CTP (Betz, 1984:10) commented on the progress made with respect to additional funding obtained from sources outside the Department: "During 1983 meetings of the HSRC and the CSIR Grants' Committees for Technikon Research were convened to grant allocations for 1983/1984."

The Department of National Education (1988) remarked that a lower level of research activity was to be expected from the technikons, because research was still a very young activity at the technikons. This, however, did not mean that research activity would not grow to become equal to the level of the universities. The first technikon research projects, which were registered in 1984, were higher qualification-based. Chapter Five refers to the statistical reality of the research activity undertaken at technikons from 1984 to 2002.

With technikon research funding becoming a recognised feature, the evaluation of research output also had to receive attention and the Department of National Education made the recommendation, "...that at least initially, the same output research indicator which presently applies to evaluating university research output, be used for technikons" (Department of National Education, 1989:11).



The measuring of research output was to become a contentious issue from within the technikon sector, especially because of the nature of the output, as well as because of the place of publication of the research outputs.

The DoE (1988:52) already at that stage acknowledged the difference in orientation between technikon and university research, claiming that one "...cannot measure the technikon's research outputs in the same way as those of the university [because] it would amount to discrimination against the technikon...". The Department of National Education (1989:11) then added "...that at least initially, the same output research indicator which presently applies to evaluating university research output, be used for technikons".

(f) The initial restructuring of technikon research funding

The funding of the expanding education system led to an investigation into the manner in which technikons were funded, not only for teaching, but also for research. The restructuring of technikon research funding, at least at face value, appeared to be the recipient of official attention. However, the speedy manner with which this restructuring was addressed did not sufficiently support the development of technikon research.

Chapter Three shows how technikon research funding was caught up in the higher education restructuring process, so that, in a manner of speaking, the funding proved so elusive it failed to reach the stage where it could effectively promote the development of a research culture at technikons.

The Department of National Education addressed the teaching and research funding component in the Policy document, 'Revision of the subsidy formula for technikons: technical report' (Department of National Education, 1992). Having recognised the status of the research culture at technikons, The Department made a number of recommendations regarding the funding of technikon research.

Firstly, the policy document acknowledged the importance of providing for research in terms of the subsidy formula. However, the Department argued that "...although there are indications that a research culture is becoming established at technikons...it is clear that the current provision in the formula is sufficient, particularly if the formula is funded in full, to create a research infrastructure



within which research activities can develop" (Department of National Education, 1992:24). The additional assumption was made that the technikon subsidy formula could be developed and based on the structure of the university formulas, despite the Department acknowledging that, in spite of this, "...the provision of instruction/research personnel for technikons was fixed at only one third of the provision for universities" (Department of National Education, 1992:1, 2).

The argument was also advanced that the remainder of the subsidy formula should be based on the manner in which the university subsidy formula was structured, though adapted to reflect "...the...lower provision for research...on all points" (Department of National Education, 1992:1, 2). The outcome of this decision led to a situation where the "...current expenditure component of the adapted subsidy formula for technikons...amounted to 81,66% of the subsidy formula for universities (research outputs excluded) (Department of National Education:1, 2).

The above exposition of the approach adopted by the Department supports the earlier comment regarding the apparent sufficiency of official attention paid to technikon research funding.

The second point to receive the attention of the Department was the provision to be made in the subsidy for a "blind" component to reward quality research output (Department of National Education, 1992). The "blind" component of the subsidy provided for the expenditure towards personnel, supplies and services; the replacement of equipment, and renewal of buildings and the acquisition of new equipment and new buildings (Department of National Education, 1992). The "blind" component, earmarked for the establishment of a research infrastructure, was automatically provided to all technikons based on the projected number of subsidised students in both the natural and human sciences. However, when compared with the SAPSE 110 and SAPSE 131 reports, this allocation is considerably smaller than the amount allocated to universities (Department of National Education, 1992). This once again shows the unfavourable position of technikon research development in terms of funding.

Thirdly, although the provision made in the Department's research programme for measuring technikon research output sufficed, the third factor that played a role

in the development of research at technikons in terms of funding was the problematic nature of trying to compare the research output of technikons with that of universities (Department of National Education, 1992). In the 1991 Annual Report, the CTP commented on the fact that the technikons finally in 1991 "...received official recognition for research outputs in the form of an addition to the State subsidy" (Du Preez, 1992:8).

When technikon output was evaluated for the first time in 1990 in view of the 1992 subsidy, a total of 21.51 units was counted in comparison with the 5 211.10 units of the universities, with all research units generating an amount of about R9 200 (Department of National Education, 1992).

The output categories accepted by the Department for technikons during that year included the registered patents, artefacts, articles appearing in approved journals, technological publications and scientific papers presented at, and bound in, the published proceedings of conferences (Uken, 1999).

(g) Academic quality assurance

Academic quality assurance added a dynamic element to technikon education initially, during the 1980s, as well as later, during the 1990s, when it was institutionalised by the Certification Council for Technikon Education. Academic quality assurance activities were initiated when the Council took responsibility for the maintenance of standards and the monitoring of quality.

One of the earliest features of quality assurance, namely central certification, was one of the outcomes of the Conference on Technical, Industrial and Commercial Education held in Pretoria in November 1911. This resolution only formally took shape many years later, with the establishment of the Certification Council for Technikon Education in terms of Act No. 88 of 1986. According to Pittendrigh, the development of central certification resulted from the dissatisfaction that existed among technikon lecturing staff as regards the examination system. Generally, at the time there was a "...sense of expectancy that the solution to all of the teaching/examining problems lies in the establishment of the Technikon Certification Council" (Pittendrigh, 1988:245).

The view was further expressed that SERTEC would be the body with the potential of being the single factor in the technikon sector capable of enhancing

educational standards over the next ten years (Pittendrigh, 1988). SERTEC held a conference in 1989 to look into the feasibility of ensuring equal standards in the sector. The committee agreed that it would not be possible for SERTEC to do this, and that it would also not attempt to do so (Jacobs, 1997).

As can be seen, the diversity in terms of capacity, size and resources within the technikon sector was already acknowledged very early on, bearing in mind that the earliest technikons were established in 1979. The issue of institutional diversity was also continuously referred to by SERTEC during the institutional visits that took place every four years (SERTEC visits, August to October 2000). In spite of this, central certification and focusing on the educational standards, as a quality assurance mechanism, became two of the pivotal features of technikon education for many years.

Further, according to Jacobs (2000:69), SERTEC was established to function as "...a certification body to be responsible for the manipulation of examination results and the awarding of certificates...". The establishment of SERTEC was based on conclusions drawn from local and overseas visits by the then Department of National Education officials. Jacobs (2000:69) reports: "The Certification Council for Technikon Education Act (Act No. 88 of 1986) was passed whereby SERTEC was established as a certification body. The first Council was appointed in 1988 and the office of SERTEC was established with the appointment of the Executive Director on 1 April 1989."

For the National DoE (1993:21), the value of the work done by SERTEC was to be found in the fact that it would "...ensure that comparable certificates represent the same standard of education" (Department of National Education, 1993:21). Another important role that SERTEC had to play in terms of standards maintenance was the accreditation of technikons to offer degrees in terms of their ability to meet certain criteria. These criteria, according to the CTP, had to be determined by the technikons themselves, in consultation with SERTEC (Committee of Technikon Principals, 1994).

From 1991 to 1992 SERTEC also made a number of changes as far as their original 'mission' was concerned. Since 1991, SERTEC was responsible for a number of issues, of which the most important was the monitoring of the quality of the certification of sound education.

Quality monitoring as a process refers to the "...monitoring of the quality of technikon education and training [that] commenced in 1991..." that took place according to the rules and regulations as determined by the Council (Jacobs, 2000:70).

In 1991, the practice of self-evaluation became part of the quality monitoring process. Jacobs (2000:70) describes the process of self-evaluation as follows: "Self-evaluation as a basis for the monitoring of education quality was introduced at the technikons...Evaluation committees, one per programme, evaluate programmes at technikons in a four-year cycle."

During the restructuring of higher education, the future role of SERTEC became a point on the educational quality agenda. According to Jacobs (2000:72), the "...legislators drafted the South African Qualifications Authority Bill on the basis of the contents of the aims of the Certification Council for Technikon Act [and] SERTEC provided assistance in this regard". In this way, the important contribution made by SERTEC to higher education was acknowledged. Such acknowledgement and involvement might have been less than the expected level of participation for which SERTEC had hoped, but it was, nevertheless, an acknowledgement of the expertise of the Council.

#### 2.6.5 Concluding remarks

One of the events of the period from 1979 to 1993 that had a major impact on the development of technikons was certainly the name change undergone in 1979.

The desire to change the name of the sector responsible for the provision of tertiary technical education stems from a very long period during which numerous attempts were made to rid the sector of its strong association with apprenticeship training and secondary vocational education. The name change was also an attempt to achieve a position of uniqueness. However, it also complicated public perceptions of the institutions concerned, resulting in the CTP and SERTEC having continuously to strive to inform the public of the type and level of education provided by technikons.

It was also during this period that historically disadvantaged technikons were established, which mirrored the political views of the then ruling party in South Africa.

The transformation of historically disadvantaged technikons would form one of the key issues addressed during the later restructuring of South African higher education.

Part of the endeavours of the CTP and SERTEC during the 1990s included clarification regarding the issue of the technikon instructional programmes, the central concern being that technikons offered technology training and focused on providing education with an orientation towards vocational education and applied problem-solving industry-based research. This period also preceded the period during which higher education started to undergo major restructuring.

Part of the restructuring process included a revisitation of funding, with the Department of National Education publishing a revised subsidy formula in 1992. The earliest funding considerations centered around the feasibility of aligning the subsidy formula of the technikons with that of the universities. Attention was given to the measurement of technikon research output and the difficulty of the publication of technikon research in the standardised accredited journals was acknowledged.

## 2.7 CONCLUSION

This chapter provides an interpretation of the events contributing to the development of technical higher education and research from the mid-1850s to the early 1990s. The discussion of the five periods covering 140 years shows that there were two types of developments that strongly influenced technical educational developments at technikons in South Africa: the first being educational developments and the second, which, during some periods, dominated the influence exerted by the first, being the industrial developments. Reference is made to the more prominent developments in each of these spheres in the summary of the key events of each of the periods concerned. The manner in which the acts formalising industrial and technical education developments almost alternated each other serves to substantiate this observation.

Other factors that played a prominent role in the developments were: the large number of committees and commissions that regularly investigated technical educational issues; the continuous underlying issue regarding systemic order; the order of the hierarchy and levels of technical education; and, lastly, the financing of technical education.

The early years of technical education in South Africa were characterised by the contribution that the Technical Institutes, the discovery of gold and diamonds and subsequent industrial developments, the apprenticeship system, the Trades Schools and, eventually, the Technical Institutes made in regard to structured and formal technical education in South Africa. All of these events formed the foundation of early South African technical education, taking technical education from infancy to a stage where the specific identity of technical education could emerge in its own right. During these years, it was mostly industrial developments that prescribed both the pace and nature of technical education developments in South Africa.

The events of this period prepared the stage for the next period, lasting from 1910 to 1923. The key event of this period from 1910 to 1923 was the formation of the Union, which necessitated that urgent attention be given to issues of control and co-ordination. As a result, and in order to start this process, the Conference on Technical, Industrial and Commercial Education was held. Certainly the most significant outcome of this conference was the appointment of Snape, who investigated the technical education offering of the time. Snape's brief was to provide the Minister of Education, Minister F.S. Malan, with an official report on the status of South African technical education. Two further outstanding events of this period were the redesignation of Technical Institutes as Technical Colleges and their inclusion in the field of higher education. It was mostly, therefore, educational and educational organisational developments that impacted on the pace and nature of technical education development during this period.

The acts that featured most prominently during this period were the Apprenticeship Act No 26 of 1922 and the Financial Adjustments Bill that became law in May 1922 and which led to the inclusion of the technical colleges in higher education.

The period from 1924 to 1947 was characterised by turmoil caused by the apparent aspirations of the technical colleges for university status. The Van der Horst Commission's report negatively impacted on the development of the technical education offering of the colleges, due to its propounding the view that the work done by the colleges was at a lower level than that done at the universities of the time.

As a result, the Association of Technical Colleges felt called to become more actively involved in building the profile of technical education.

The issue of control as well as that of financing technical education became a priority for both the Association, as well as the Union government. World War II contributed to the development of technical education by enhancing the value of formally organised and co-ordinated technical education in terms of demands made for the war effort. Such demands led to a steady growth in the number of new colleges, and helped set a sound basis for the advancement of technical education during the following period. Subsequent developments were influenced by the work of the Van der Horst and De Villiers Commissions, as well as by the Eybers Committee. The official investigations of the time mostly looked into the issues of financing, control, the status of the technical education offering, and the qualification hierarchy.

The period from 1948 to 1978 was fruitful for the technical colleges. The key factors contributing to the advance of technical education during this period included the introduction of the 'sandwich course', as the technician's diploma was popularly known, and the higher diploma for those who had successfully completed the technician's diploma.

With the addition of this course, the qualification structure of the colleges was extended, contributing to the ability of the institutions to take up their rightful place as institutions of higher learning. The findings of the Goode Commission played a major role in the above-mentioned developments, leading to the addition of the research function as a further contribution to the advanced nature of technical education. It was, therefore, mostly educational developments that impacted on the nature and pace of technical education developments during these years. In this respect, the Vocational Education Act No. 70 and the work of the Goode Commission contributed most significantly.

The outstanding events of the period from 1979 to 1993 were the redesignation of the technical colleges as technikons, the establishment of the historically disadvantaged technikons and the contribution of the CTP and the Certification Council for Technikon Education. The notion of 'tertiary' technikon education and the practice and promotion of technology formed the focal point of the debates, while the position of research in relation to these two issues was refined.

In the early 1990s, the first effects of a changing South Africa were felt in the technikon sector with the publication of the Education Renewal Strategy. As a result of this publication, the financing of research at technikons also received attention, with the DoE publishing its position on this matter in its NATED (92/11) policy statement.



## **CHAPTER THREE**

# **TECHNIKONS IN THE POST-APARTHEID HIGHER EDUCATION LANDSCAPE**

## CHAPTER THREE

### TECHNIKONS IN THE POST-APARTHEID HIGHER EDUCATION LANDSCAPE

	PAGE
3.1 INTRODUCTION	92
3.2 EMERGING HIGHER EDUCATION CHANGES FROM 1991 TO 1993	93
3.2.1 The DoE's Renewal Strategy	94
(a) Declining economic growth	
(b) Equal educational opportunities	
(c) Managerial effectiveness	
3.2.2 The National Education Policy Investigation	99
(a) Central control and post-secondary governance structures	
(b) Post-secondary size and shape options	
3.2.3 Concluding remarks	102
3.3 THE HIGHER EDUCATION RESTRUCTURING PROCESS	106
3.3.1 Size and shape	107
(a) The establishment of the CHE and the brief of the Task Team	
(b) Diversity and differentiation in South African higher education	
(c) Criteria for grouping South African HEIs	
(d) The infusion of South African higher education with social purpose	
(e) The previous versus the emerging higher education landscape	
(f) Outcomes of the reconfiguration exercise	
(g) The processes informing the higher education reconfiguration	
3.3.2 A single co-ordinated system	117
(a) The purpose of the National Plan	
(b) Steering mechanisms to effect higher education restructuring	
(c) The features of a single national co-ordinated system	
(d) The Ministry's response to the CHE model of diversity and differentiation	
(e) Uniformity, UoTs and horizontal differentiation	
(f) Institutional, programme and infrastructural collaboration and new forms of institutions	

3.3.3	The regional higher education profile	123
	(a) The NWG recommendations on institutional forms	
	(b) The CTP's response to the NWG recommendations	
	(c) The Ministry's response to the NWG recommendations	
	(d) The Ministry's proposals regarding the regional institutional landscape	
	(e) The regional merged HEI profile	
	(f) The CTP's response to the new institutional profile	
	(g) The guidelines for mergers and incorporations	
3.3.4	The restructuring of government technikon research funding	136
	(a) The inequalities between technikon and university subsidy research funding	
	(b) The alignment of research funding with the co-ordinated national priority system	
	(c) Output subsidy	
3.3.5	The restructuring of agency technikon research funding	146
	(a) The establishment of the NRF	
	(b) The establishment of the NRF Technikon Research Development Programme	
	(c) The establishment of research priorities and the focus area funding framework	
3.3.6	A new approach to quality assurance	149
3.4	CONCLUSION	151

## CHAPTER THREE

### TECHNIKONS IN THE POST-APARTHEID HIGHER EDUCATION LANDSCAPE

#### 3.1 INTRODUCTION

The restructuring of South African public higher education was set in motion in the early 1990s by means of the Educational Renewal Strategy, launched by the Department of National Education, and the investigation of the National Education Policy Investigation, known as NEPI. The latter investigation addressed the following three issues that later were at the core of higher education restructuring: the central co-ordination; the unification; and the desired size and shape of higher education. Restructuring of the sector became more focused and incisive during the 1990s, with the publication of the White Paper on Higher Education Transformation and the Higher Education Act in 1997.

South African technikons, as public providers of higher education, were also subjected to the higher education restructuring process, resulting more recently in the continuation of 10 of the former 15 technikons as UoTs within the unified university landscape. A central purpose of the chapter is therefore to show of technikons were not only affected by, but also participated in the restructuring process. I show the sentiments of and the position taken by the technikon officials in terms of the role technikons should assume in the new higher education landscape.

The restructuring of the higher education landscape was premised in the transformation of a model diverse in terms of the presence of universities and technikons to an unified higher education system. The restructured higher education model, however, now again consists of three “types” of universities, unified in terms of central control and administration. We see how the evolution of certain central technikon education concepts such as career education, vocational education, tertiary education, technology education as well as technological education, discussed in Chapter Two, were indicators of the technikons transforming the sector from within to provide technical higher education (technological education) as Universities of Technology.

Other than the structural transformation of higher education to create a future education model for South Africa, the funding of higher education also received attention.

According to Blankly (1997:1) this was mainly a result of a decline in the amount of government funding available for research. He noted as follows: The "...effects of inflation, rising rates of foreign exchange and re-prioritised government budgets have eroded the strength of public research funds". In this context, the Government reviewed the subsidy structure and the allocation of research units for research in accredited publications. This effectively led, on 14 October 2003, to the replacement of the educational policies regarding technikon research output embodied in Report 024/97 and those regarding university research output embodied in Report 014/97, with one policy that sought to address the future funding of higher education research output.

This chapter presents an interpretation of the Educational Renewal Strategy, the investigation undertaken by the National Education Policy Investigation and the following elements of the higher education restructuring process:

- the size and shape of higher education;
- the issue of a single co-ordinated system;
- the regional higher education profile;
- the restructuring of government and agency technikon research funding;
- and
- a new approach to quality assurance.

### 3.2 EMERGING HIGHER EDUCATION CHANGES FROM 1991 TO 1993

To describe the emerging higher education changes that commenced in the early 1990s, the issues raised in two major primary documents are discussed. The first of the documents is the report on the Education Renewal Strategy launched by the Department of National Education in May 1990 and the second is the report of the National Education Policy Unit based on its investigation into the issues pertinent to South African education at that time. At various stages in the discussion, reference is also made to discourse participated in by higher education academics.

The purpose of the discussion revolving around the Education Renewal Strategy is to highlight the reasons that, according to the government, necessitated education renewal. To provide perspective on the legitimacy of the government's education renewal strategy, the parallel independent investigation conducted by the Education Policy Unit, known as the NEPI report, is reviewed.

The work done by these two forums served as an important platform for the restructuring of higher education during the next decade and led to a revolutionised higher education landscape, which significantly impacted on the trajectory of the technikon sector. At the time, the Committee of Technikon Principals was satisfied with the direction taken by the education renewal strategy, because the strategy had a strong vocational orientation, resulting, according to the CTP, from the committee's meaningful input (Du Preez, 1992:4).

### 3.2.1 The DoE's Renewal Strategy

The need for the renewal of the structure and organisation of education was expressed in various government circles. As a result, the Department of National Education launched the Education Renewal Strategy on 18 May 1990. According to Wiid (1991:3), who represented the Committee of Technikon Principals on this Investigation, the Department divided its work into 20 different areas that aimed at solving both the short- and medium-term problems being experienced in the education system.

The renewal strategy focused on renewing educational management by means of the proposals that it made in terms of practical solutions directed at the improvement of education. Mabandla (1993:11), in her analysis of the strategic position of the Education Renewal Strategy, found the strategy to have been "...conceived and constructed in secrecy by a group of bureaucrats who make up the Committee of Heads of Education Departments...". The expression of such a view demonstrates that not all South Africans were convinced that the process initiated by the government in order to renew education would be free from bias.

A number of reasons were cited by the Education Department for why the system of education should be renewed. The first was the "...so-called ten year plan announced by the Minister of National Education in 1986" (Department of National Education, 1992:1). This plan was based on an increase of approximately 4.4% in learner numbers experienced by the education system. Mabandla (1993:11) also referred to the "...so-called ten year plan announced by the Minister of National Education in 1986 where an attempt was to be made to deal with the phenomenal rise in black pupil numbers as against a resource base that was gradually shrinking...". The fact that the education department, as well as Mabandla, referred to the 1986 plan as a "so called plan" creates the impression that the plan was not regarded as a legitimate platform for the renewal of education.

In support of my interpretation of the implicit spirit expressed by Mabandla's view and regarding the anticipated explosion of higher education, Hay, Fourie and Hay (2001:101) claimed that the "...expected and predicted massification of South African higher education has not occurred". The National Committee for Higher Education in 1996 predicted that 680 000 students "...would be enrolled at universities and technikons by 1999, [but] the overall headcount...for that year only amounted to 564 000" (Hay, Fourie & Hay, 2001:101).

The issues linked to the growth in learner numbers, cited as the reasons for the renewal of education, were the declining economic growth rate linked to reduced public expenditure and a decrease in the education budget; the need for alternative ways of funding due to an expanding education system; the presence of developing and developed communities in South Africa; the need to create equal education opportunities and to eliminate backlogs and, lastly, the need to investigate the education model and the managerial effectiveness of the system (Department of National Education, 1992; Mabandla, 1993).

(a) Declining economic growth

The Department of National Education identified the country's declining economic growth as a reason for launching a strategy aimed at the renewal of education in South Africa. The decline in economic growth was linked to the Government's commitment to reduce public expenditure, which led to a decrease in the education budget in real terms (Department of National Education, 1992:1; Eckert, 1994).

At the same time, the expanding education system worsened the impact of the decline in economic growth. As a result, in May 1989, the Minister of National Education announced that the Government would have to look for alternative solutions to the funding problems, requesting the co-operation of education colleagues with embarking on a "...co-ordinated approach towards rationalisation in education" (Ibidem). Eckert (1994:28) also addressed the anticipated funding problem that higher education would be most likely to encounter. He mentioned that higher education would not "...likely see more than 20 percent of the 20 percent of the national budget which will be allocated to education". Eckert refers to the tendency to move towards skills-based education, as opposed to concept-based education, as suggesting "that technikons may have the stronger claim to new funding in the new term" (Eckert, 1994:28).

The Department referred to the tension that existed in regard to the provision of quality education as a result of the presence of both developing and developed communities in South Africa. These "...countries as a rule have to contend with strong social, economic and political pressure for high quality education [and] the state's inability to meet the demands for education in such countries results in the building up of backlogs in the provision of education, which often heightens the frustration level in society..." (Department of National Education, 1992:9–10). The Education Renewal Strategy therefore addressed the need to "...actively address the backlogs in the provision of education that have accumulated in the developing communities" (Department of National Education, 1992:9–10). The backlogs were of a socio-economic nature as well, and, as a result, one of the aims of addressing the renewal of education was to equip learners to "...make a meaningful contribution towards economic growth in South Africa" (Department of National Education, 1992:12).

(b) Equal educational opportunities

Another factor linked to the anticipated growth in student numbers was the slow progress in the creation of equal educational opportunities (Department of National Education, 1992:8–9). The Education Renewal Strategy (Department of National Education, 1992:79) referred to the Government's position regarding the creation of equal educational opportunities: "The Government has repeatedly committed itself to education policy that will promote meaningful progress towards equal educational opportunities for all learners in South Africa."

Already as early as 1989, the Committee of Technikon Principals referred to the creation of equal educational opportunities for all population groups: "As a result of certain views...the Executive Committee of the CTP decided [to] create the opportunity to discuss 'equal educational opportunities for all population groups'..." (Steyl, 1989:11). At this point in time the CTP was not only concerned about the provision of equal educational opportunities for all population groups, but also about the elimination of the backlogs that existed at the technikon level (Steyl, 1989:11).

(c) Managerial effectiveness

Part of the criticism of the legitimacy of the education system was the managerial ineffectiveness experienced within the system (Department of National Education, 1992:15; Mabandla, 1993).



However, the realisation prevailed that "...an education system cannot be transformed overnight [and] the authorities acknowledged that "...in establishing a new education system, [the current education system, complying] with all educational requirements...should under no circumstances be dismantled" (Department of National Education, 1992:12).

As a guide to the renewal of the education system, the report listed eleven principles used as the "...norm for the provision of education...", since the present education system was not performing according to the principles that had previously been set out (Department of National Education, 1992:15). The principles pertinent to the discussion are:

- the provision of equal education opportunities;
- the need to balance commonality with diversity in education;
- the relevancy of the curriculum to the person power needs of the country;
- the establishment of a positive link between formal and non-formal education; and
- the need to balance administrative centralisation with adequate and necessary decentralisation (Department of National Education, 1992:15).

According to Grobbelaar (1993:62), the aforementioned principles were actually the result of the investigation undertaken by the De Lange Committee in 1981, which were formally accepted as the "Principles for Education in the RSA". Grobbelaar (1993:63) further mentioned that the Committee of Heads of Education Departments, which was primarily responsible for formulating the education renewal strategy, subscribed in full to these principles.

In 1993, strangely enough, the Department of National Education, in a demonstration of its willingness to embark on a systematic renewal of education, subscribed to principles that were 12 years old and not even displayed by the education system at the time. Such a move did not serve to instil confidence in the capacity of the government to embrace such a renewal process.

Regarding diversity, the strategy highlighted the use of an "...unacceptable and educationally irrelevant basis for accommodating diversity, namely race..." (Department of National Education, 1992:16). Further, the strategy claimed that a unitary education system in fact existed, but that "...the population group basis of the present system has largely contributed to a perception that unity or commonality does not feature at all..." (Ibid).

The assertion of the existence of a unitary system was open to question by those living in South Africa at the time. The position taken by the government regarding this led to a deep-rooted quest for restructuring and transformation experienced from within the education forums themselves. Eckert (1994:26) also referred to the "exceptional diversity" that would prove a challenge unique to South Africa, saying South Africa had the capacity to serve as a role model for the policy-makers of other divided countries also in need of healing. Grobbelaar (1993) discussed possible ways in which diversity could be dealt with in the future higher education system. Though he briefly referred to language, access and student profile as different dimensions of diversity, he focused his attention on the manner in which diversity should be addressed in terms of institutional purpose. The conclusion that he reached was that the unitary higher education system should consist of institutions similar in appearance, but each with a different focus.

As part of its investigation aimed at identifying the best educational model for future South African education, attention was paid to the type of macrostructure that "...would best lend itself to the realisation of the objectives of the education dispensation envisaged..." (Department of National Education, 1992:17). On this point, the Education Renewal Strategy concluded that the main decision requiring to be made was that a balance had to be struck between a politically centralised and decentralised macro education structure (Department of National Education, 1992:17).

The link between an appropriate education system, the influence and role of a particular political system and the difference between original and delegated power had therefore to be addressed and it was concluded that "...although certain central structures are necessary for the sake of the broad synchronisation and integration of the education system and to ensure the necessary cohesion in the development of education, there is...also a need for a strong decentralised system..." (Department of National Education, 1992:23). It was acknowledged that "...a new education dispensation will...mean placing the authority levels encountered in a pyramidal pattern from the central to the local level in a certain relationship to each other. Educational functions have consequently to be allocated in accordance with the powers of every level of authority" (Department of National Education, 1992:23).

Mabandla (1993:11), in support of the extent of political and economic accountability assigned to the different governance levels, also referred to the strong preference of the ERS for a federal constitutional solution. According to Mabandla, this type of constitution required a central education authority to establish the norms and standards and to be responsible for the national autonomous institutions and strong regional educational authorities with the original responsibility of providing appropriate levels of education (Mabandla, 1993:11).

The foregoing discussion of the government investigation aimed at renewing South African education in the early 1990s is reminiscent of the continuous addressing of issues of co-ordination and control that took place in the various periods of development of technical education, as discussed in the previous chapter. Essentially, the government claimed that it was in favour of educational renewal to counter the decline in economic growth and to reduce public expenditure, thus freeing up more financial resources that could be spent on education. Simultaneously, the government wanted to make quality education available to all people in South Africa on an equal basis, which, it realised, would put still further strain on the education system.

Such were the issues that largely formed the backbone of the restructuring of South African higher education. In response to the claim made by the government, the NEPI team conducted a parallel investigation. The team paid attention to a number of issues, which are to be discussed under two headings that relate strongly to the main issues emanating from the above discussion: central control and higher education governance structures and the future post-secondary system's size and shape options.

### 3.2.2 The National Education Policy Investigation

The NEPI investigation was a project conducted under the auspices of the National Education Co-ordinating Committee between December 1990 and August 1992 with the purpose of interrogating "...policy options in all areas of education..." (Cloete & Nkhulu, 1992:vii). Such interrogation was to be undertaken within a framework of values and ideals relating to the broad democratic movement (Cloete & Nkhulu, 1992:vii). NEPI was excited about the fact that the investigation promised a new period of successful "collaborative effort amongst political leaders, academics, and practitioners" (Cloete & Nkhulu, 1992:vii), which

was to have a profound impact on the way in which future South African education would be conceived.

Eckert's 1994 environmental scan of education dealt with a South Africa that had reached a stage where the central government could no longer continue unilaterally to formulate educational policy, but on where policy formulation would indubitably be characterised by consensual processes. Eckert expressed this view quite forcibly, saying that the "...emergence of consultation and participatory decision making...[will become the]...mandatory *modus operandi*" (Eckert, 1994:26) and that the mandate for "...consensual decision making will seek expression in the daily operations and management of post-secondary institutions" (Eckert, 1994:28).

NEPI referred to the absence of national debate regarding a number of issues central to higher education in the technikon sector, especially those of the feasibility of a unitary post-secondary system for South Africa and the shape and size of the future post-secondary education system. According to NEPI, technikons were, at the time, mainly involved with the following issues: enhancing career education; investigating the possibility of amending the qualification structure, so that technikons could offer bachelors, masters and doctoral degrees; the need to expand the technikon system; and the need to improve the articulation of the post-secondary system. NEPI further questioned the extent to which technikons were producing the human resources essential to rapid economic progress (Cloete & Nkhulu, 1992:69). The current analysis of the annual CTP reports supports this observation made by Cloete and Nkhulu.

The extent to which technikons were successful in producing the necessary human resources required for economic progress in South Africa in relation to the enhancement of the qualification structure and the cultivation of a research culture are discussed in Chapter Four and statistics reflecting the reality of the anticipated developments are supplied in Chapter Five.

(a) Central control and post-secondary governance structures

As seen from the discussion in Chapter Two, the matter of the control of education received continued attention throughout almost every period of the development of technical higher education. Central control was also the first issue addressed by NEPI, with the recommendation being made that the post-secondary education sector should operate within a single, central education ministry, together with

regional education departments and institutional structures (Cloete & Nkhulu, 1992:60). The proposal was also put forward that the technikons should have the same level of autonomy as that of the universities and that the central education department would oversee all existing universities and technikons (Cloete & Nkhulu, 1992:60). This proposal was in line with those expressed in terms of the Education Renewal Strategy.

NEPI proposed a system of central control, due to the negative impact that the fifteen education departments had had on the efficiency of educational control that had been plagued by problems emanating from a decentralisation based on racial diversity. "The South African government has admitted that its present 'education model'...based on the 'own affairs/general affairs' distinction...led to the establishment of fifteen separate ministries of education...[and] lacked legitimacy (Cloete & Nkhulu, 1992:43, 91).

The CTP constantly referred to the problems that such a situation created for it as a committee, which had to function within two contexts. Firstly, the different education departments to which each of the technikon principals was accountable was rife with inconsistencies. At the same time, the principals formed part of a central Committee informing the Minister of Education on issues pertaining to all technikons, irrespective of which education department in reality governed a particular technikon.

The CTP, already as early as 1985 (Steyl, 1986:8), argued for the centralisation of all tertiary education under the control of the Department of National Education, stating: "It is significant...that while all technikons in South Africa are...members of the CTP...the individual technikons fall under the jurisdiction of the various Departments of Education and Culture and the Department of Education and Training".

According to the CTP, the distributed manner in which the principals had to perform their duties led to unnecessary problems, frustrations and friction among the CTP members (Steyl, 1986:8). The CTP, therefore, firmly agreed that their "...task as a statutory body would be greatly assisted if all tertiary education could be placed under one controlling department" (Shippey, 1987:6). The Committee was of the opinion that the placement of all tertiary education under one controlling department would ease the existing tensions and, because of this, the

CTP would be in a better position to play an essential role in tertiary education (Shippey, 1987:6).

NEPI also investigated the issue of governance structures and considered the feasibility of three possibilities for the future post-secondary education system: sector-based; centralised; or regionalised.

Firstly, a sector-based option would be "...a variation on the current South African model [that] ...assumes that the PSE sector will have three distinct sub-sectors, that each will be served by a representative 'interest group', and that other constituencies will have access to policy decisions through an advisory or 'buffer' body" (Cloete & Nkhulu, 1992:81). This option, according to NEPI, would probably be the most feasible to implement due to the basic structures, apart from the single ministry of education, already being in existence (Cloete & Nkhulu, 1992:81).

Secondly, the centralised option would differ from the sector-based option in a number of ways. According to Cloete and Nkhulu (1992:82), "The main feature of this option is the introduction of a national education council to replace the advisory council of the first option. The national education council would deal with matters delegated to it by the minister of education and matters for which it has statutory responsibility. Its main function would be to formulate and to monitor the implementation of a national PSE plan."

Thirdly, the regional option could be seen as a variation on the centralised option. This option would lend the national education council the same main functions that it has in the centralised option. In addition, however, this option would also be, in effect, a mixture of decentralisation and deconcentration. The decentralisation would endow post-secondary education with the authority of local government structures and the deconcentration would devolve public authority from that of a position of centrality to that a variety of regional authorities, as well as to the individual post-secondary institutions themselves (Cloete & Nkhulu, 1992:84). According to Eckert (1994:26), the "...significant devolution to regional and local authorities..." would be one of the key areas addressed by future South African education policy.

## (b) Post-secondary size and shape options

In the spirit of the points raised in regard to the need for central control, NEPI pointed out that the South African post-secondary system consisted of three subsystems: the university subsystem; a technikon subsystem; and a professional subsystem. Each subsystem had its own strong lines of differentiation regarding its nature and functions. The feasibility of this trinary divide was subject to review (Cloete & Nkhulu, 1992).

A clear definition of each of the subsystems had hence to be determined. NEPI referred to two differences that existed between the university and the non-university institutions. The first was the difference in the teaching approach. "The approach to teaching at technikons is practical in the sense that their courses concentrate on the application of knowledge..." (Cloete & Nkhulu, 1992:16). This point is reminiscent of the view raised by Khotseng, as discussed in Chapter Two.

The second was the difference in the orientation towards knowledge. "A sound knowledge of science has to be built up in technikon students, but this knowledge is presented in ways that have its...application...in mind..." (Cloete & Nkhulu, 1992:16). Technikon students were, accordingly, never expected to be as much concerned with abstract thinking and the scientific approach as was the university student. The education, therefore, provided by non-university post-secondary education institutions was vocationally-oriented and the primary function of technikons was to train technologists (Cloete & Nkhulu, 1992:16). This meant that technikons were primarily involved in the development and distribution of technological knowledge, which they did by means of practical or applied research and the instruction of students (Cloete & Nkhulu, 1992).

NEPI saw the possibility of a number of options that could contribute to a sound new educational system for the future South African post-secondary education system. NEPI's description of the unitary differentiated option has to be seen against the background of the development of the higher education changes. "A variation on the trinary option would be a unitary option which does not attempt to draw distinctions in kind [and] differences between institutions in the system would be drawn on the basis of the specific functions which they would be required to 'deliver'..." (Cloete & Nkhulu, 1992:92). Earlier reference was made to Grobbelaar's (1993) comments on the handling of diversity in striving for a unitary system.



Grobbelaar, in discussing the options suggested by NEPI, pointed out that the system should be well organised and have a proper system of accreditation, so that students could progress between the institutions.

A single system meant that the trinary divide that characterised South Africa's post-secondary education system did not have to be repeated in the new education system. NEPI, however, declared that avoiding this model would challenge the *status quo* (Grobbelaar 1993:66, 68). The other implementation problems, according to Grobbelaar (1993:68), would consist of overcoming resistance to change, the dominance of stronger partners, cultural and/or ideological differences, managerial difficulties, the loss of autonomy and investigation and fear regarding the possible loss of capacity to maintain standards. The implementation problems identified during the early 1990s stayed part of the perception of higher education academics, as illustrated by an investigation conducted by Hay, Fourie and Hay (2001:102).

They issued a number of warnings in regard to the merging process, stating that a successful merger would depend on such factors as a strong effort to build a sense of a common culture for each new institution and sufficient time for institutional change to occur.

NEPI highlighted that the final size of South African post-secondary education would depend mainly on the access option adopted by the future government. "If a trinary system is adopted, then a particular kind of framework for the shape of the system will have to be determined. If a unitary system is adopted...this framework and the range of 'possible shapes' will be different" (Cloete & Nkuhlu, 1992:104). The final shape would also depend on whether the government adopt a 'demand-driven' option or a 'centrally planned' option" (Cloete & Nkuhlu, 1992:104)

As the reconfiguration of the higher education landscape neared completion, the centrally planned option that demonstrated the government's desire to intervene and steer received consideration. The shape of higher education also changed from the trinary divide, based on function, to a unitary system, in which the institutions concerned were subject to less definitive functionally-based divisions.

The much appreciated consensual spirit in which the reconfiguration and transformation of higher education commenced was not sustained, for which Fataar (2003:33) offers an explanation. "Globally inspired processes had a



decisive impact on the policy force field...forcing the government to adopt a more interventionist approach in steering the system...higher education is...replete with internationally recognisable discourse [such as] an emphasis on greater efficiency...quality assurance, fitness for/and purpose...managerialism". More attention is paid to these points in the discussion of the unfolding of higher education restructuring in the next decade, which was effectively introduced by the report released by the Council of Higher Education Size and Shape Task Team in 2000.

### 3.2.3 Concluding remarks

The issue of the organising and funding of technical education already featured as problematic as early as during the years from 1853 to 1909, with its once again resurfacing as a prominent concern during the years from 1924 to 1947.

The issue stayed part of the educational debate until in 1991, when the Department of National Education felt compelled to take up a position and to demonstrate its willingness to renew South African education. The emerging political changes in South Africa necessitated a firm commitment from the government to the proposal of changes that would accommodate the changing demographic profile of learners wanting access to higher education in South Africa. At the same time, the government did not wish to compromise the quality of education. The growing demand for access to education, especially to higher education, had to be dealt with, which led to an ever-growing need for more efficient control and co-ordination.

As a result, this issue formed the foundation of the Education Renewal Strategy and the NEPI investigation. Both these Investigations concluded that governance structures had to be reviewed in order to enhance managerial effectiveness. All indications served to confirm the belief that central control would solve the educational problems experienced in the public higher education system of the time.

The issue of the size and shape of higher education was another prominent issues raised by NEPI. As mentioned, this issue came under considerable debate early in the next decade, because this issue was so closely related to that of which type of governance structures should be implemented as part of the new higher education landscape.

As part of the National System of Innovation, the NRF was established in 1999 by joining the FRD, which historically had funded natural sciences research, and the Centre for Science Development (CSD), which historically had funded social sciences research.

In 2002, the NRF published the Technikon Research Development Programme Framework, covering the period from 2002 to 2007. The main elements of the programme framework consisted of the institutional approach to research capacity development; the operational framework, consisting of a number of core strategies; and the implementation of these strategies.

The higher education restructuring process came to an end in 2005, when the second group of merging institutions would open its doors as a group of merged institutions. In the discussion that follows focuses on the first phase of higher education restructuring, as completed in terms of the Committee for Higher Education (CHE) Task Team investigation.

The discussion centres around the following key issues:

- the establishment of the CHE and the brief of the Task Team;
- the qualitative and quantitative institutional size and shape features;
- the integrated diverse and differentiated system;
- the contrast between the previous and the emerging system;
- the effectiveness, efficiency and equity challenges involved;
- the outcomes of the reconfiguration exercise;
- the process that informed the higher education reconfiguration; and
- the characteristics of a differentiated diverse system.

### 3.3.1 Size and shape

#### (a) The establishment of the CHE and the brief of the Task Team

The Higher Education Act, No. 101 of 1997 enacted the establishment of a Council on Higher Education (CHE, 2000). According to Fataar (2003:35), the CHE was established in terms of the Green Paper on Higher Education, which was published in 1996, as a result of the prevailing fear that control over the policy process would be lost, and that the "...Ministry and Department of Education act as mediators among competing policy positions in the NCHE's proposed forums...[which would lead to] ...the inability to make decisive policy decisions".

Chapter Two of the Act outlines the establishment, functions and composition of the council (Republic of South Africa, 1997:A761–771). In terms of the Act, the CHE was meant to replace the University and Technikon Advisory Councils: "The University and Technikons Advisory Council...continues to exist and to perform its functions...until the CHE commences its functions in terms of this Act (Republic of South Africa, 1997:A799).

The Ministry requested finality on the institutional restructuring, with attention being paid to the long-term affordability and sustainability of the higher education system. The CHE was to provide the Ministry with concrete proposals on the size and shape of the higher education system (Council on Higher Education, 2000).

The CHE Task Team expressed its belief in the vitally important role that higher education should play in achieving democracy, social justice and the economic and social development of South Africa (Council on Higher Education, 2000). The team explained its brief as "...an overarching exercise designed to put strategies into place to ensure that our higher education system is indeed on the road to the 21<sup>st</sup> century" (Council on Higher Education, 2000:5).

The CHE Task Team identified a need to reconfigure the present post-secondary system and to create a new higher education landscape. The problems and weaknesses of the higher education system had to be dealt with systemically. Such an effort would require well co-ordinated interventions and investigations as well as "...extensive, integrated, iterative national planning..." (Council on Higher Education, 2000:5). The reconfiguration process would also require institutions to display the political will, sustained commitment and sufficient courage to make the necessary changes (Council on Higher Education, 2000). The Task Team mentioned that, if the vision of a rational, seamless higher education system was to be realised, the shape and size of the higher education system should be well planned and structured.

The mission and location of HEIs would, of necessity, have to be re-examined in light of the strategic plan for the sector, as well as the education needs of local communities and the nation at large. For this purpose, the Education Ministry had to draw up a national plan for higher education positioned within the framework of the government's policy, as described in the Education White Paper 3.

According to the CHE, the plan would represent a "...break from the past - a past largely dictated by the geo-political imagination of apartheid planners" (Council on Higher Education, 2000:5-7). The publication of the National Plan for Higher Education in 2001 displays an acknowledgement of the integrated national planning and co-ordinated interventions and Investigations desired by the CHE.

(b) Diversity and differentiation in South African higher education

The CHE proposed three categories of institutions as its model for a diverse and differentiated higher education landscape, the first category of which included the 'bedrock institutions', in which limited postgraduate programmes, in line with the institutional missions, would be offered up to a taught master's level. Research would relate to the curriculum, with learning and teaching being undertaken with a view to application. The CHE motivated for the presence, orientation and focus of 'bedrock institutions' as follows:

- "The future political, economic and social well-being of South Africa is crucially dependent on the quality of the first degrees and diplomas of graduates...
- The country critically requires as the bedrock of its higher education system institutions that are dedicated predominantly to undergraduate teaching...
- Such institutions should constitute the foundation of the higher education system and also the great majority of institutions...
- They are crucial in ensuring equity and redress through increasing and widening participation based on appropriate admission requirements...
- ...these institutions will face the challenge of providing...equity of opportunity...the geographic location of these institutions...must... be put to use to strengthen equity...
- Such institutions would function as multi-purpose institutions operating across a broad range of learning areas...
- The vital role that the current technikons play in co-operative education and producing technically competent and skilled diplomats in a range of science, engineering and technology fields should be expanded...
- Academics with research capabilities will continue to have access to research funding..." (Council on Higher Education, 2000:39–40).

The CHE attached a high value to these institutions, because having a sufficient number of institutions producing first-degree graduates and diplomates would be critical for the sustained political, economic and social well-being of South Africa. The bedrock institutions would, however, be multi-purpose institutions and be positioned geographically in such a way that issues relating to the equity of opportunity, by means of access and participation, could be addressed. The CHE agreed to retain the technological nature of the technikons concerned.

The CHE proposed that the second category consist of those institutions offering comprehensive postgraduate taught and research programmes up to doctoral level. Extensive research capabilities could be gained at these institutions, including basic, applied, strategic and developmental research capabilities across a broad range of areas.

In its motivation for the presence of 'comprehensive postgraduate and research institutions' in the changed higher education landscape and in its outline of the 'orientation and focus', the CHE Task Team (Council on Higher Education, 2000:41–42) included the following points:

- The social value of these institutions would be "...to produce high-level graduates and knowledge producers..."
- "The constraints of available human and financial resources...permit the development of only a limited number of institutions with such a mandate..."
- Dedicated funding for postgraduate teaching and research would have to be made available, though "...not necessarily be across the board ...".
- The institutions concerned would be held accountable for eroding the pattern of research as the preserve of mainly white male South Africans, thus accepting social responsibility for transformation that would lead to the increasing development of both black and women graduates.
- This category of institutions would put the required infrastructure in place in order to secure the internationalisation of their student bodies
- The institutions concerned would also "...pursue strong partnerships with the science councils ...".

The third category of institutions would focus on extensive postgraduate taught and research programmes up to master's level, selective postgraduate taught and research programmes up to doctoral level, and only certain areas of research on basic, applied, strategic and developmental research level.

In its motivation for the presence of 'extensive master's and selective doctoral institutions' in the changed higher education landscape and in its outline of the appropriate 'orientation and focus', the CHE Task Team projected a more limited scope for knowledge production and for production by high-level knowledge producers (Council on Higher Education, 2000).

According to Uken (2001:239), the CHE report was accepted by the CTP for the following reason: "...reading between the lines, technikons hope that this document at least accepts technikons as part of a unified university structure, paving the way for universities of technology". Uken (2001:39) continued, "...unfortunately the Size and Shape Task Team saw fit to confine all research activities at technikons to research in teaching methods". The only comment made on the work done by the CHE in the annual reports of the CTP was the need it expressed to investigate the proposals made by the CHE (Balintulo, 2001).

From the NWG recommendations and the final restructuring proposals of the Ministry of Higher Education it was clear that the Government of the time did not publicly commit itself to the establishment of a unified university structure.

(c) Criteria for grouping South African HEIs

In addition to the three categories described above, the CHE developed the following additional set of criteria as indicated in Table 2, that should be applied when grouping the HEIs, namely:

- the number of full-time equivalents (FTEs);
- the spread of such FTEs over the fields of study concerned;
- the number of FTEs in science, engineering and technology (SET) of a technological nature;
- the number of FTEs on the master's and doctoral levels;
- the number of staff with higher degree qualifications; and
- the research output (Council on Higher Education, 2000:39–43).

TABLE 2: QUANTITATIVE INSTITUTIONAL SIZE AND SHAPE FEATURES

Criteria	Category one Institutions	Category two institutions	Category three Institutions
% of FTEs	4 000	8 000	6 000
Spread over fields of study	Even spread	15% in Humanities 10% in Commerce 25% in SET	35% in Humanities 10% in Commerce 15% in SET
% of FTEs in SET for technological orientation	25% of FTE enrollments	50% of FTE enrollments	30% of FTE enrollments
% of master's and doctoral FTEs	No requirement	minimum 10% on master's and doctoral level	minimum 5% on master's and doctoral level
% of staff with higher degrees	No requirement	40% with relevant doctorates	30% with doctorates
Research output	No requirement	Not less than 0.5 units	Not less than 0.2 units

(d) The infusion of South African higher education with social purpose

The CHE Task Team related its model for a differentiated and diverse higher education system to a number of social purposes for higher education, outlined in the White Paper of 1997. In Chapter One of its report, it referred to a number of goals, principles and values that South African HEIs had to achieve and institutionalise (Council on Higher Education, 2000:12, 13).

The CHE Task Team also argued that the rationale for its model of the size and shape of the higher education system was linked to the social purposes espoused for higher education. By this, it meant that the higher education system should be well-organised and that the "...vibrant research and development system..." would align its training and research with South Africa's industrial needs, as well as with the social reconstruction Investigations involved. Higher education should achieve this by producing, acquiring and applying new knowledge (Council on Higher Education, 2000:12, 13). In relation to this point, the Task Team stated that one of the goals of the White Paper was "...knowledge production which is responsive to societal interests and needs", adding that a "...key policy goal is the establishment of a national, integrated, co-ordinated and differentiated higher education system" (Council on Higher Education, 2000:13).

This view of the CHE is exactly what lies at the heart of Fataar's (2003:35) observation that the higher education policy discourse was increasingly being exposed to "...the changing demands placed on the state for decisive policy and for alignment with the government's chosen macro-economic path after 1996".



The Task Team, however, acknowledged that the integrated, yet differentiated and diverse higher education landscape would only be achieved by means of three steering mechanisms, namely by government funding, national and institutional planning and quality assurance mechanisms (Council on Higher Education, 2000).

Such a finding once again underlines the steadily decreasing presence of the earlier-started consensual process much appreciated by higher education participants. In this connection, Fataar (2003:37) explicitly says, "...the Ministry chose an interventionist steering approach..."

(e) The previous versus the emerging higher education landscape

The Task Team identified some of the changes taking place between the previous dispensation and the higher education landscape in the new South Africa in its focus on the following three issues:

- the "...effective realisation of policy goals and the efficient and accountable use of public resources..."
- an accelerated incorporation of information and communication technologies in learning and teaching... [and]
- the quick mobilisation of "...human and financial resources for the effective steering and regulation of higher education" (Council on Higher Education, 2000:15).

The work of the Task Team formed part of the overall national planning Investigation, which culminated in the National Plan for Higher Education. The Task Team mentioned that the "...orderly reconfiguration and development of higher education..." would need a substantial amount of direction "...from the Department of Education on certain Investigations and activities of higher education institutions..." (Council on Higher Education, 2000:15–16). This was necessary due to lack of clear evidence of any contribution being made by higher education to social and economic growth (Council on Higher Education, 2000:15–16).

A number of key problems related to the geographic location of HEIs. The first problem was that of fragmentation and unnecessary duplication.



The second problem was the way in which universities and technikons acted as market competitors, rather than as colleagues bent on attaining a unified and co-ordinated higher education system. The third concern related to the minimal, erratic research outputs of most institutions (Council on Higher Education, 2000:17–19).

In addition, a few situational problems plagued higher education, in particular that the participation rate had remained static and was estimated at only 15% for the age group 20–24 for 1999. Some institutions were also thought to be likely to experience difficulties in funding their activities until the finalisation of the new funding framework (Council on Higher Education, 2000:20–21). In addition, the number of private HEIs had increased dramatically and, lastly, a number of institutions possessed only a fragile capacity to govern themselves effectively (Council on Higher Education, 2000:17–19).

The systemic problems of higher education were identified by the CHE (2000:21–22) as including the following:

- There was a lack of overall coherence.
- Socio-economic development needs were being dealt with irrationally and inappropriately.
- The size of the system, including overall enrolments, participation rates and the number of institutions concerned, was unwieldy.
- The shape of the system, including the nature of the institutions involved, their mandates and focus, the levels and range of their programme offerings, and their disciplinary orientation, was cumbersome.
- The modes of educational delivery were inadequate.

A number of key effectiveness challenges were presented by the number of outputs in the areas of graduate and research output. "The dangers posed to the knowledge needs of society and the economy by low and declining numbers of research outputs also need to be addressed by measures aimed at increasing the numbers of researchers as well as research outputs from higher education institutions" (Council on Higher Education, 2000:22, 23). The second challenge was that of achieving efficiency in regard to quality and sound planning measures, and the third challenge was that of setting up and maintaining equity targets for all programmes, staff and students concerned (Council on Higher Education, 2000).

(f) Outcomes of the reconfiguration exercise

The CHE Task Team concluded its report with a discussion of some of the outcomes of the reconfiguration exercise. The main points covered the attainment of a more rational landscape, envisaged by the reconfiguration of the higher education system, which referred to a more clearly defined range of institutional mandates that would encourage institutions "...to have coherent and more defined purposes in their production of knowledge and graduates" (Council on Higher Education, 2000:23–24). Furthermore, a more rational landscape would be more likely to lead to the achievement of the goals and objectives of the White Paper and, lastly, a more focused framework for innovation in teaching, learning, research and community service.

According to the CHE, studies "...on the relationship between knowledge production and economic and social development have demonstrated the critical importance of the creation of new knowledge" (Council on Higher Education, 2000:28). The CHE was of the opinion that "...a central feature of South Africa's economic policy is meeting the challenge of international competitiveness [and therefore the] availability of skills in the sciences and the technological, technical and business fields is a precondition for competitive success in the production of a wide range of internationally traded goods" (Council on Higher Education, 2000:28).

On the role of higher education in economic growth and development, as well as in the provision of the necessary skills for South Africa, the Task Team said, "The manufacturing, processing and service sectors, which will have a dominant impact upon the country's economic future, will depend much more on the knowledge produced and applied in and by higher education institutions..." (Council on Higher Education, 2000:8–9). The ability to think abstractly was becoming a requirement in all the professions. Therefore, if educational systems wanted to respond to social needs and development challenges, they would have to conduct "...applied and strategic research around key social policy issues and the concrete problems of social reconstruction and development..." (Council on Higher Education, 2000:8–9). This research and the "...continuous enhancement of the knowledge, competencies and skills of public sector personnel is necessary for innovation, improved social delivery and development" (Council on Higher Education, 2000:8–9).

(g) The processes informing the higher education reconfiguration

In Chapter Three of the report, the CHE Task Team reported on two key processes of the higher education reconfiguration: the process of differentiation and diversification, and that of integration and co-ordination.

The Task Team's view was that the "higher education institutions that were inherited by democratic South Africa have their roots in an apartheid social order" and that some "institutions unreservedly served the apartheid government's goals and policies" (Council on Higher Education, 2000:32). While the strengths of the current higher education system were acknowledged, the Task Team was concerned that, "...overall, the inherited system is not effectively responding to the new needs of the country and it is essential to reconfigure it to serve the new democracy" (Council on Higher Education, 2000:32).

In order to achieve this aim, the "country requires institutions with particular social mandates and a diversity of institutions with different and distinct missions" (Council on Higher Education, 2000:32). To substantiate such a requirement, the Task Team referred to the call of the White Paper for "...a coherent, co-ordinated and integrated national higher education system that is simultaneously differentiated and characterised by diversity" (Council on Higher Education, 2000:34).

Very important contextual issues for research at technikons were discussed in the section, "The Case for Differentiation and Diversity". According to the Task Team (Council on Higher Education, 2000:34), "The terms 'differentiation' and 'diversity'...are both distinct and connected. 'Differentiation' is used to refer to the social and educational mandates of institutions. The mandates orient institutions to meet economic and social goals by focusing on programmes at particular levels of the qualification structure and on particular kinds of research and community service." Further, there were certain qualitative and quantitative measures that referred to the mandates of institutions, namely minimum student FTEs, minimum enrolments in broad fields, staff qualifications and research output. Diversity referred to the respective missions that individual institutions would formulate (Council on Higher Education, 2000). The important link between differentiation and diversity they described as related, "...in that mandates provide the overall national framework within which individual institutions pursue specific institutional missions" (Council on Higher Education, 2000:34).

The CHE Task Team also outlined the key characteristics of public higher education (Council on Higher Education, 2000). The first characteristic was the benefit to be gained by having multi-purpose, rather than single-purpose, institutions. The second characteristic of public higher education, as described by the CHE Task Team, was that of the academic and economic viability of such institutions. The third characteristic of the differentiated and diverse higher education system was the research involvement of institutions. The work done by the CHE Task Team mainly covered organising South African higher education into three categories of institutions in terms of a number of quantitative criteria that made provision for differentiation and diversity in a markedly different way to that formerly operating in terms of racial bias.

The report, however, was met with the "...accusation of reproducing apartheid" (Fataar, 2003:37) and was criticised for containing "...technically unsound rigidly demarcated...options that was rejected by...higher education stakeholders" (Fataar, 2003:37). Such a response from within the ranks of higher education mostly left the Ministry of Education no option but to appoint a NWG to advise the Minister on the restructuring of higher education, as addressed in terms of the National Plan for Higher Education. Such restructuring would focus on issues of steering mechanisms, horizontal differentiation, inter-institutional collaboration and the consideration of completely new forms of HEIs that would effectively display the new definition of South African diversity. The importance of having a single co-ordinated higher education system for South Africa, which was raised by the CHE Task Team, served as the focus of the National Plan for Higher Education, which was released in 2001.

### 3.3.2 A single co-ordinated system

#### (a) The purpose of the National Plan

The National Plan also embodied the Minister's response to advice provided by the CHE regarding the restructuring of the higher education system (Department of Education, 2000:5). The Plan referred to the "...critical and central role [the Plan had] to play in contributing to the development of an information society...in terms of skills development and research" (Department of Education, 2000:6).

Section One of the Plan addressed the challenges facing higher education and the role of higher education in a knowledge-driven world, according acknowledgement of the fact that the challenges were created by "...the

phenomenon of globalisation" (Department of Education, 2000:5). The new century was recognised as bringing with it certain social, economic and cultural changes generated by the "revolution in information and communications technology". The pivotal importance of knowledge and the processing of information was seen in light of their serving as "...key driving forces for wealth creation and...social and economic development" (Department of Education, 2000:5).

The Minister of Education, Prof. Kader Asmal, in addressing the media, stated categorically that all debate and consultation regarding the future higher education landscape had come to a close (Asmal, 2001). The higher education restructuring debate opened with the policy options proposed by NEPI in the early 1990s and closed with the National Plan, which was the final response to all the contributing reports considered.

The Minister of Education referred to the vision of the Education White Paper encapsulated in its addressing the re-examination of the mission and location of HEIs (Council on Higher Education, 2000:38). Both their mission and location were to be in line with the strategies and goals for the sector, as well as with "...the educational needs of local communities and the nation at large in the 21<sup>st</sup> century". The establishment of a single, national co-ordinated system was seen as central to this vision (Department of Education, 2000:5).

The purpose of the National Plan, therefore, was to outline the "...framework and mechanisms for implementing and realising the policy goals of the White Paper" (Department of Education, 2000:6). The plan also aimed at coherence in the provision of higher education, the effective and efficient use of limited resources, the responsible use of public funds and the attainment of high-quality academic programmes (Department of Education, 2000:6).

Section One of the plan concluded with an overview of the structure of the National Plan, reflecting the overall goal of the transformation of the higher education system (Department of Education, 2000:14). The objectives and strategies entailed in the national plan for higher education restructuring were cited as including the following:

- increased access to educational resources;
- equity of access to such;
- diversity in organisational form and institutional landscape;

- high-level research capacity building; and
- the building of new institutional and organisational forms and new institutional identities through regional collaboration established between institutions (Department of Education, 2000:14–15).

(b) Steering mechanisms to effect higher education restructuring

The plan referred to the implementation of three steering mechanisms, namely the planning process, funding and an appropriate regulatory framework (Department of Education, 2000). As was seen in the previous section, the necessity of implementing steering mechanisms in order to ensure the successful restructuring of higher education was identified by the CHE Task Team. According to the Ministry of Education, the purpose of the steering mechanisms was also to provide a framework and outline processes for the restructuring of the institutional landscape of the higher education system, as well as for the development of institutional plans" (Department of Education, 2000:12).

The steering mechanisms, which would be implemented in order to achieve the desired restructured higher education landscape, included "...indicative targets for the size and shape of the higher education system, including overall growth and participation rates, institutional and programme mixes and equity and efficiency goals" (Department of Education, 2000:12). The plan pointed out that the absence of a national plan had resulted in a climate of competition between public HEIs, leading to a fragmented system that provoked inequalities (Department of Education, 2000).

The Minister agreed with the CHE Task Team that "[t]he categories of 'historically advantaged' and 'historically disadvantaged' are becoming less useful for social policy purposes..." (Council on Higher Education, 2000:14 in Department of Education, 2000:10). The institutions concerned had to develop clear missions and a sense of purpose, as well as structures for effective administration, governance and management that would support the mission" (Department of Education, 2000:11). The Minister therefore agreed with the CHE's "...suggestion that attention must be paid to the identification of new missions, which would enable institutions that were disadvantaged to develop new directions and trajectories" (Department of Education, 2000:11).

(c) The features of a single national co-ordinated system

According to the Ministry, diversity was to be achieved in organisational forms and institutional landscapes. "The White Paper makes it clear that the overarching policy goal of establishing a single national co-ordinated higher education system does not mean a uniform system" (Department of Education, 2000:50).

The White Paper argued that the potential pressures exerted towards attaining uniformity could be avoided by "...recognising the broad function and mission of universities, technikons and colleges as three types of institutions offering higher education programmes" (White Paper: 2.39–2.41 in Department of Education, 2000:50). The Ministry recognised the aspirations of many institutions "...to a common 'gold' standard as represented by the major research institutions..." and stated that the 'rolling' plans must outline the institution's "...vision and mission, its values and goals and its academic and research direction on the basis of an analysis of its social, economic, political, intellectual and cultural context" (White Paper: 2.39–2.41 in Department of Education, 2000:50).

One of the noteworthy characteristics of the 'old' diversity was that "Technikons, in contrast to universities, play an important role in providing career-oriented programmes at the diploma level, in particular in science, engineering and technology" (Department of Education, 2000:52). The new diversity would now be reflected in a variety of organisational forms, not by certain types of institutions providing certain types of education.

(d) The Ministry's response to the CHE model of diversity and differentiation

The National Plan referred to the measures proposed by the CHE for the successful handling of issues of diversity and differentiation. The Ministry referred specially to one area of differentiation identified by the CHE, namely the institutional type (Department of Education, 2000:52). The Ministry did not support the CHE's recommendation "...that differentiation and diversity should be achieved through structural differentiation between different institutional types based on a distinction between teaching and research institutions" (Department of Education, 2000:54).

In light of the above, the Ministerial support of diversity and differentiation from a programme-based approach is noteworthy.



The plan set out that "...the mission and programme mix of institutions is defined by a predetermined regulatory framework based on structural differentiation between different institutional types" (Department of Education, 2000:54). Fataar (2003:35), also stated that a "new integrated and coordinated unitary structure...would be driven by a programme-based institutional approach built in into institutional plans...in line with an overall national plan", adding that the coordination would be facilitated by a national qualifications framework "...centrally steered by the Higher Education Department of the DOE in cooperation with the CHE".

The Ministry did not agree with the CHE recommendation that research resources should be concentrated in the comprehensive research and postgraduate training institutions (Department of Education, 2000:75), because "...it would destroy the pockets of research excellence, limited as it may be, in the historically black universities and the technikons more generally". The lack of agreement must not, however, create the impression that the Ministry approved a "...blanket approach to the allocation of research resources... [research resources [should rather] be concentrated in the institutions with "...demonstrated capacity or potential based on approved mission and programme profiles" (Department of Education, 2000:75).

(e) Uniformity, UoTs and horizontal differentiation

The National Plan addressed the issues of uniformity, UoTs and horizontal differentiation. "Prior to the Higher Education Act of 1997...technikons and universities were formally regulated and funded as separate sectors, that is, the higher education system was divided along binary lines" (Department of National Education, 2000:54). The 'binary line' referred to the higher education system in place during the first decade of the twentieth century in the United Kingdom, from where the South African system had, itself, originated.

In the National Plan, the Ministry stated that the programme distinction between technikons and universities was eroded "...in line with the White Paper's suggestion of a 'loosening of boundaries' between institutional types" (Department of Education, 2000:56). The removal of the programme distinction and the cap placed on degree-granting rights of technikons so contributed to uniformity that the technikons requested a change in their status to that of UoTs.



The Ministry proposed to continue to "...recognize...in the short to medium-term, the broad function and mission of universities and technikons as two types of institutions offering different kinds of higher education programmes" (Department of Education, 2000:57).

The proposal meant that for at least the next five years the Ministry would regard technikons as institutions with the primary function to "...provide career-oriented programmes at the diploma level..." (Department of Education, 2000:57). The Ministry qualified this important statement by stating that "[t]he technikons will not be precluded from offering on a limited basis, career-oriented degree programmes, including postgraduate programmes, as is the case currently" (Department of Education, 2000:58).

The decision to continue to treat technikons and universities as two types of institutions with different functions and missions "...is likely to be objected to by the technikon sector...", but the Ministry said that the taking of this decision was in the interest of the higher education sector, as the model implemented in this respect met the current social and economic development needs of South Africa. (Department of Education, 2000:58).

The redefinition of technikons as UoTs created a new set of research demands. When discussing these demands, the following point raised by the CTP must be taken into account: "...the positive growth in postgraduate courses and research by technikons are creating a fairly complex higher education landscape [that]...will cause...confusion and may detrimentally affect the technikons remaining after the reconfiguration of the higher education sector" (Committee of Technikon Principals, 2003:4).

- (f) Institutional, programme and infrastructural collaboration and new forms of institutions

The last section of the National Plan for Higher Education discusses the restructuring of the institutional landscape, with special reference to institutional collaboration, programme and infrastructural collaboration and new institutional and organisational forms. The Ministry states that it "...believes that the processes of institutional restructuring and merger must be premised on the principle that higher education programmes would continue to be offered at all the current geographical sites, but within new institutional and organisational forms and structures" (Department of Education, 2000:87).

In addition, "...the current institutional landscape is not suitable to meet the human resource and knowledge needs of South Africa..." (Department of Education, 2000:88). Accordingly, the proposal was made that the Ministry look into "...the feasibility of reducing the number of institutions and establishing new institutional and organisational forms through a more rational arrangement for consolidating the provision of higher education on a regional basis" (Department of Education, 2000:88). The "...focus of the investigation would not be on whether the number of institutions can or should be reduced, but how they can be reduced and the form that restructured institutions should take" (Department of Education, 2000:88).

This point, amongst others, led to the establishment of the NWG that looked into restructuring the manner in which higher education was organised at that stage. The Minister of Education appointed a working group to "...advise...on the appropriate arrangements for restructuring the provision of higher education on a regional basis through the development of new institutional and organisational forms, including institutional mergers and rationalisation of programme development and delivery" (Asmal, 2002b).

### 3.3.3 Regional co-operation

#### (a) The NWG recommendations on institutional forms

The document titled "The Restructuring of the Higher Education System in South Africa", referred to in educational discourse as the NWG recommendations on regional cooperation, was issued by the Minister of Education on 31 January 2002.

The Minister expressed his satisfaction with the work done by the working group and said the report "...provides the basis for taking forward the restructuring of the higher education system to enable it to respond to the equity and developmental challenges that are critical for improving the quality of life of all...people" (Asmal, 2002c).

The recommendations made by the NWG were twofold. The first set of recommendations covered general issues affecting all regions, while the second set addressed the consolidation of HEIs on a regional basis through the establishment of new institutional forms.

The consolidation also made provision for the reduction in the number of HEIs from 36 to 21 by means of mergers (Macozoma, 2002). According to the NWG, "...regional collaboration could best be promoted by applying an appropriate mix of incentives and sanctions through utilising the programme approval and funding processes outlined in the National Plan for Higher Education" (Macozoma, 2002). The incentives and sanctions envisaged refer to the steering mechanisms leading to the National Plan for Higher Education.

Regarding universities and technikons, the NWG supported "...the view that universities and technikons should continue to operate as higher education institutions with distinct programmes and mission foci. It did not support the suggestion that technikons be renamed 'universities of technology', but was of the view that an alternative such as 'institute of technology' could be considered, where this status is appropriate" (Macozoma, 2002).

The status of all the institutions in the newly reconfigured higher education landscape was one of the issues that required attention. The issue of the status of technikons, like many other issues, was not new.

International influences played a role in the decision that led to the name change of the three technikons in Natal to the Durban Institute of Technology. As discussed in Chapter Two, Natal was one of the provinces that implemented the Scottish educational models on a continuous basis.

The NWG's recommendation regarding this name was noteworthy, because in 1978 the Goode Commission had recommended use of the same name. The Commission recommended "...that...an improved name for CATE should be adopted and recommends Institute of Technology" (Goode *et al.*, 1978:91).

The Working Group also proposed comprehensive institutions, which would result from a merger of universities and technikons to form part of a single co-ordinated system (Macozoma, 2002). The Working Group, however, cautioned against academic drift, which would involve the loss of clear identity for both degree and diploma programmes, as well as the focus and function of these programmes and the attendant research. Finally, the Working Group recommended that colleges of agriculture and nursing become part of the higher education system" (Macozoma, 2002).

Hay, Fourie and Hay (2001:101) provide an interesting exposition of the non-uniqueness of merging and regionalisation of higher education. The “university was a regional body long before higher education institutions were brought together in systems or recognised as national bodies... [and]...the governance of these institutions was largely a local or regional matter”. The first universities were respectively established by a local duke in Grenoble in 1329, by the Leiden municipality in 1575 and by the local archbishop in the case of Glasgow University ( Hay, Fourie & Hay, 2001).

Table 3 indicates the merger recommendations affecting technikons and technikon-type programmes made by the NWG.

TABLE 3: NWG MERGER RECOMMENDATIONS

Province	Type of institution	Notes
Eastern Cape	Comprehensive Institution and a technikon	Merger between UPE and PE Technikon and a merger between Border Technikon and Eastern Cape Technikon
Free State	Technikon Free State to be retained	
Gauteng	Technikon	Merger between Technikon North West, Technikon Northern Gauteng and Technikon Pretoria
Natal	Technikon	Merger between ML Sultan Technikon, Technikon Natal and Mangosutho Technikon
Northern Province	Comprehensive institution	University of the North, University of Venda and Medunsa should refocus their programmes to include university and technikon-type programmes
North West	Comprehensive institution	Potchefstroom University should refocus its programmes to include university and technikon-type programmes
Western Cape	Cape Technikon to be retained	Peninsula Technikon and University of the Western Cape to merge to form a comprehensive institution

(b) The CTP's response to the NWG recommendations

The Committee of Technikon Principals responded to the report of the NWG by saying that it was unfortunate that “...mergers appear to have been the only

instrument..." to reduce the number of HEIs (Du Pré, 2002:1). The CTP further mentioned the requisites for successful mergers and highlighted the implementation difficulties faced by the Department (Du Pré, 2002). The committee was also concerned about the impression created by the NWG that it consulted widely in putting the report together. Further, according to the CTP, the "...NWG has missed an opportunity to meaningfully 'restructure' the system" since, as they maintain, "...the exercise to reduce the number of institutions is fundamentally flawed" (Du Pré, 2002:1).

The committee was concerned about the manner in which technikons were dealt with by the NWG. Firstly, they were of the opinion that technikons have been measured "...against long-established institutions in the areas of degrees, research outputs, infrastructure, qualifications of staff, etc...", whereas technikons are a young player in the provision of South African higher education (Du Pré, 2002:1, 2).

Secondly, the "...NWG did not give enough consideration to the role of the technikons in this country" ( Du Pré, 2002:1, 2). The CTP reminded the NWG that the Ministry, in the National Plan for Higher Education, referred to the role that technikons had been, and were still, playing in the development of the necessary human resources and in the supply of skills required in South Africa.

In restructuring the higher education system, the NWG proposed a drastic reduction in the number of technikons and, as already mentioned, in the effectiveness and efficiency with which the technikons would be able, in future, to play a meaningful role in the development of South African human resources. The role that they would play, especially in the field of technology, became an issue for concern. The Ministry's response, which referred to an increase in access to technikon-type programmes achieved by the convenient geographical positioning of comprehensive universities, as well as by the refocusing of some former traditional universities, has already been addressed in this thesis.

The third technikon-specific concern was the issue of designation, which was addressed in full in the previous chapter. Reference was also made earlier in this discussion to the designation 'Institute of Technology', as suggested by the Goode Commission as early as 1978.

Fourthly, the CTP was concerned about the identity of the comprehensive institutions, consisting of those technikons that merged with universities, as well

as that of the universities that were to offer technikon-type programmes. The NWG was thought to have exceeded its mandate when it argued against renaming technikons 'universities of technology'. The extent to which UoTs had been conceptualised was also of concern (Du Pré, 2002:2).

In conclusion, the CTP made two suggestions. The first referred to the expansion of the technological higher education sector by, at the very least, increasing the number of technikons and the second to protecting and ensuring the continuation of designation of all institutions resulting from mergers, whether between universities and technikons, or between technikons and technikons, 'universities of technology', which term would also be used to refer to universities offering technikon-type programmes (Du Pré, 2002). If these proposals were not implemented, it would "...be clearly discriminatory against technikons..." and the marginalisation of technikons would be a continued process..." (Du Pré, 2002:2). The final reconfiguration of the higher education landscape bears witness that this suggestion was, indeed, implemented.

(c) The Ministry's response to the NWG recommendations

In the document released by the Ministry of Education early in June 2002, the Ministry essentially expressed its satisfaction with the work done by the NWG (Department of Education, 2002:7). The Ministry acknowledged the concerns raised by the higher education sector that the narrow focus of the NWG firstly restricted its focus to only acknowledging mergers as the sole instrument appropriate for the implementation of diversity and differentiation and, secondly, led to an inadequate consultative process (Department of Education, 2002:7). The Ministry, however, did not agree with the two concerns raised, saying that the "... NWG's approach is consistent with the National Plan..." (Department of Education, 2002:7).

Regarding the methodology used, the Ministry took note of the concerns raised in terms of the accuracy of the institutional data used as a basis for the work of the NWG, as well as the utility and limitations of the performance indicators and benchmarks" (Department of Education, 2002:7). The Ministry, however, did not agree with the criticism, explaining that institutions were responsible for supplying the data used by the NWG.

As far as the performance indicators were concerned, the Ministry mentioned that the NWG acknowledged the limitations of the indicators and benchmarks concerned (Department of Education, 2002).

However, the Ministry once again pointed out the importance of performance indicators and benchmarks "...for analytical and monitoring purposes", adding that the NWG "...has not...narrowly relied on the indicators and benchmarks to underpin its merger proposals" (Department of Education, 2002:7). The response of the Ministry of Education to the recommendations of the NWG was presented as a set of restructuring proposals for higher education, announced in a press release on 30 May 2002, as well as in a document, officially announced in the Government Gazette of June 2002, titled "Transforming and Restructuring: A New Institutional Landscape for Higher Education".

This document also contained the Minister's view regarding the proposed mergers. A follow-up press statement was made by the DoE on 9 December 2002, to which the CTP officially responded on 12 December 2002. A further document, entitled "Higher education restructuring and transformation, guidelines for mergers and incorporations", was released in April 2003.

In the May 2002 press statement, the Minister of Education, Professor Kader Asmal, said "...Cabinet approved the government's groundbreaking proposals for the transformation and reconstruction of higher education", adding "[i]t is clear to Government that the status quo could not be maintained and that radical steps would be needed if the system were to play its pivotal role in responding to the many challenges that our country faces" (Asmal, 2002b).

The Minister also referred to the appointment of an NWG to advise on the restructuring of the institutional landscape of the higher education system. The Minister said that the new system would "...comprise of 21 higher education institutions, consisting of 11 universities, 6 technikons and 4 comprehensive institutions...", and that the formation of comprehensive institutions would "...strengthen the provision of technikon programmes through ensuring that technikon programmes...are available throughout the country..." (Asmal, 2002b). The Minister stressed that no institution would be left untouched by the merger process and that the institutions not directly feeling any immediate impact should pay urgent attention to equity targets for both staff and students..." (Asmal, 2002b).



(d) The Ministry's proposals regarding the regional institutional landscape

The Ministry of Education referred to the need for transforming and restructuring the higher education system to meet the following three needs, emanating particularly from the Education White Paper 3: social justice; effectively coping with the challenges "...associated with the phenomenon of globalisation..."; and ensuring "that limited resources are effectively and efficiently utilised..." (Department of Education, 2002:4, 5).

The Ministry mentioned that the National Plan for Higher Education would provide a framework for the implementation of the vision of the single national co-ordinated higher education system outlined in the White Paper (Department of Education, 2002:4, 5). The five policy goals and strategic objectives of the National Plan (Department of Education, 2002:5) consisted of:

- the increased access and release of graduates with the necessary skills and competencies to meet the human resource needs of the country;
- the promotion of equity of access to ensure staff and student profiles that reflect the demography of South Africa;
- the achievement of diversity in the higher education landscape by means of mission and programme differentiation;
- the building of research capacity and the promotion of research in line with national development needs; and
- the building of new institutional identities and organisational forms that would transcend the fragmentation, inequalities and inefficiencies of the apartheid past .

The Ministry agreed with all the mergers proposed by the NWG, except for those of the Peninsula Technikon and the University of the Western Cape and of the University of Fort Hare with Rhodes University and the Medical School of the University of the Transkei.

The Ministry disagreed with the proposal that the Rand Afrikaans University and the Witwatersrand Technikon remain separate. In addition, the Ministry disagreed with the proposals regarding the incorporation of the East Rand and Soweto campuses of Vista University and the proposal that the infrastructure of the Technikon North-West be retained (Department of Education, 2002:9).



With regard to technikons, the Ministry made certain proposals based on the principle of regional co-operation.

- In the Eastern Cape, Port Elizabeth Technikon and the University of Port Elizabeth were to merge with the Port Elizabeth campus of Vista University to form a comprehensive institution. Border Technikon and the Eastern Cape Technikon were also to merge, using the University of Transkei's infrastructure for its Umtata site, while the other site would be in East London.
- The infrastructure of the University of Transkei would form the core of the academic activities of the Umtata site of the new technikon, while also serving as the centre for the new dedicated distance education institution (Department of Education, 2002:11).
- Though the Free State Technikon would continue its operations as a separate institution, it would have to incorporate the Welkom campus of Vista University. In Gauteng, the Rand Afrikaans University and Technikon Witwatersrand would merge to form a comprehensive institution incorporating the East Rand and Soweto campuses of Vista University. The three technikons in the Tshwane Metropole, Technikon Northern Gauteng, Technikon North-West and Technikon Pretoria, were expected to merge.
- Vaal Triangle Technikon would continue to operate as a separate institution, with the infrastructure and the facilities of the Sebokeng campus of Vista University being transferred to the technikon (Department of Education, 2002:12, 13).
- Regarding regional co-operation, the Ministry referred to the merger proposal made by the NWG in its reference to the merger of the ML Sultan Technikon with the Technikon Natal to become the Durban Institute of Technology. The Ministry was of the view that Mangosuthu Technikon should join this merger.

In addition, the infrastructure and facilities, though not the staff and students, would be transferred to the Durban Institute of Technology.

- The University of Zululand was expected to refocus its mission and to become a comprehensive institution offering technikon-type programmes in addition to a limited number of university programmes.
- In the Limpopo region, the University of the North, the University of Venda and the Medical University of South Africa were expected to merge and

develop, with the introduction of technikon-type vocational programmes and qualifications in line with the needs profile of the region (Department of Education, 2002:13).

- In the Western Cape, the Cape Technikon and the Peninsula Technikon were also expected to merge (Department of Education, 2002:14).

The new institutional landscape, with its 21 HEIs, would consist of 11 universities, of which two would offer technikon-type programmes. There would be six technikons and four comprehensive institutions, of which three would be established by means of a merger between a technikon and a university and one by means of the redevelopment and refocusing of an existing university (Department of Education, 2002:20).

(e) The regional merged HEI profile

The outcome of the regionally-based mergers was as follows:

- In the Eastern Cape, a comprehensive institution would be formed by the merger of the University of Port Elizabeth with the Port Elizabeth Technikon, and a technikon would be formed by the merger of the Border Technikon with the Eastern Cape Technikon. Two universities would continue to exist, namely Fort Hare University and Rhodes University.
- The three universities in the Western Cape would continue, respectively, to be the University of Cape Town, the University of the Western Cape and Stellenbosch University. A single technikon would result from the merger of the Cape and Peninsula Technikons.
- In the Free State, there would be one university and one technikon.
- KwaZulu-Natal would have two technikons, namely the Durban Institute of Technology and the refocused University of Zululand, and one university, namely the University of KwaZulu-Natal.
- In the Limpopo region, a single university would result from the merger of Potchefstroom University with the University of the North West.
- One comprehensive institution, which would result from the merger of the University of the North, with the Medical University of South Africa and the University of Venda, would offer technikon-type programmes.
- Two technikons would remain in Gauteng, one being the result of a merger between the Pretoria Technikon, the Technikon Northern Gauteng and the Technikon North West, while the other would be the Vaal Triangle Technikon. In addition, there would be two comprehensive institutions, the one arising

from the merger of the Rand Afrikaans University with the Witwatersrand Technikon and the other from the merger of the University of South Africa with Technikon South Africa. There would also be two universities, namely the University of the Witwatersrand and the University of Pretoria.

In his press statement of 9 December 2002, the Minister of Education, Prof Kader Asmal, mentioned that "...the Cabinet approved the final proposals for the restructuring of the institutional landscape of the higher education system" (Asmal, 2002c), further stating, "We can now focus, not only on the implementation of the new institutional framework but also on the other vital elements of the National Plan for Higher Education which have to date been somewhat lost in the debates on mergers" (Asmal, 2002c ).

The Minister mentioned a further merger accepted by the Cabinet in May 2002, namely that of the University of the North with Medunsa. Though the University of Venda would be retained, it would have to refocus, becoming a comprehensive institution offering technikon-type and university-type programmes relevant to the region (Asmal, 2002b).

An additional recommendation was that of the merger of the Border Technikon with the Eastern Cape Technikon and the University of Transkei to establish a comprehensive institution. However, the new institution should largely offer technikon-type programmes and only relevant university-type programmes.

The final list of the mergers that would be implemented made provision for the following mergers:

- the University of Natal with the University of Durban-Westville;
- Potchefstroom University with the University of North West;
- Technikon Pretoria with the Technikon Northern Gauteng and Technikon North West;
- the University of Fort Hare with the East London campus of Rhodes University;
- the University of Port Elizabeth with the Port Elizabeth Technikon;
- the University of the North with Medunsa;
- UNITRA with the Border Technikon and the Eastern Cape Technikon;
- the Rand Afrikaans University with the Technikon Witwatersrand; and
- the Cape Technikon with the Peninsula Technikon.

The first group of mergers was to take place in January 2004 and the second in January 2005, in relation to which the Minister said, "It must be reiterated that the merger decisions should not be seen in isolation, but in conjunction with the other policy goals and objectives of the National Plan for Higher Education". The new funding arrangements were due to be finalised in 2003 (Asmal, 2002c). In mid-November 2004, the new Minister of Education, Ms N Pandor, announced the postponement from January to July 2005 of the merger of the Eastern Cape Technikon with the Border Technikon and the University of Transkei (Correspondence circulated to staff from the Registrar).

(f) The CTP's response to the new institutional profile

On 12 December 2002, the Executive Directorate of the CTP responded to the press statement made in connection with the new institutional profile. The Committee cautiously supported the transformation and restructuring policy of the Minister and acknowledged the contribution that the mergers would inevitably make to the greater diversity and increased productivity of the educational sector of South Africa (Du Pré, 2002). According to Du Pré (2002), the then chairperson of the CTP, Prof Hennie Snyman, noted, "The mergers would bring an end to the discrimination with regards to the funding of technikons and at long last, there would be equity as far as the funding of academic salaries and research are concerned".

The CTP, however, urged the Minister to give urgent attention to the clarification of the use of the names concerned, including those of 'university', 'university of technology', 'university of science and technology', 'technikon', and 'institute of technology'. The Committee acknowledged that the merging of universities and technikons to form comprehensive institutions would increase the diversity within the higher education sector..." (Du Pré, 2002). The CTP lastly mentioned that it was "...particularly pleased that the Department intends establishing a Merger Unit to oversee...the complex merger process. It is concerned however, that insufficient funding has been reserved to finance the restructuring process" (Du Pré, 2002).

(g) The guidelines for mergers and incorporations

In April 2003, the Ministry of Education published the final restructured higher education landscape (Department of Education, 2003:92).

The Ministry supplied a framework for the management and implementation of the mergers on the institutional level, as well as guidelines regarding the financial support that the DoE would provide for mergers. The guidelines (Department of Education, 2003) on the following issues also served to provide a structural outline for the processes undergone during the pre-merger, interim and post-merger phases:

- academic planning, quality assurance and research;
- student support and administration;
- human resources;
- financial management and administration;
- information and communication technology; and
- library and information services.

Table 4 indicates the names of the newly-established institutions as present in the final higher education landscape.

TABLE 4: NEW HIGHER EDUCATION LANDSCAPE

Merger partners and incorporations	New name
<b>General Universities</b>	
University of Potchefstroom, University of North West and the Sebokeng campus of Vista University	North West University
University of the North and Medunsa	University of Limpopo
	University of Cape Town
University of Natal and University of Durban-Westville	University of KwaZulu-Natal
University of Fort Hare and the East London campus of Rhodes University	University of Fort Hare
	Rhodes University
	University of Stellenbosch
	University of the Western Cape
	University of the Witwatersrand
University of Pretoria and the Mamelodi Campus of Vista University	University of Pretoria
<b>Universities of Technology</b>	
Pretoria Technikon, Technikon Northern Gauteng and North West Technikon	Tshwane University of Technology
Cape Technikon and Peninsula Technikon	Cape Peninsula University of Technology
Technikon Free State and the Welkom Campus of Vista University	Central University of Technology
Durban Institute of Technology, Magosuthu Technikon and the Umlazi Campus of the University of Zululand	Durban Institute of Technology
Vaal Triangle Technikon, incorporating the facilities of the Sebokeng Campus of Vista University	Vaal University of Technology

Comprehensive universities	
Rand Afrikaans University and the Technikon Witwatersrand (including the Soweto and East Rand campuses of Vista University)	University of Johannesburg
UNISA, Technikon SA and Vista University Distance Education Campus	University of South Africa
University of Port Elizabeth and Port Elizabeth Technikon (including the Port Elizabeth campus of Vista University)	Nelson Mandela Metropolitan University
	University of Zululand
	University of Venda for Science and Technology
University of Transkei, Border Technikon and Eastern Cape Technikon	Walter Sisulu University for Science and Technology, Eastern Cape

The rest of the discussion centred around the pre-merger phase, the interim phase and the post-merger phases of institutional research. The main issue that institutions had to address was the management, development and promotion of research. Special attention was paid to the line management relationships existing between the different research administration offices on the campuses concerned (Department of Education, 2003:38).

Institutions were requested to pay attention to research administration and policies and research projects and programmes during the pre-merger phase (Department of Education, 2003:40), especially with regard to the merging of "...existing policies and structure which govern the conduct and funding of research" (Department of Education, 2003:41). The Ministry, assuming that all HEIs had functioning research committees, requested that they "...combine to make as much progress as possible on key issues...", such as in advising the senate on research policy; in recommending how research funds were to be allocated; in developing a code of ethics and quality management systems for research; in making informed decisions regarding the entrance requirements to higher research degrees and the rules for higher degrees; and in deciding on policy issues regarding supervisory practices (Department of Education, 2003:41).

The Ministry (Department of Education, 2003:44) requested that institutions should develop proposals regarding the alignment of research administration, policies and procedures during the interim phase, which should cover the following issues:

- the institutional budgetary allocation to research;
- the allocation of institutional research funds to researchers and projects;

- the financial and supervisory support granted to post-graduate students;
- the appropriate rewards for publications;
- intellectual property rights;
- contract research and staff consulting;
- the status of, and support for, independent research units;
- conference grants;
- the alignment of research databases;
- the administration of research scholarships and bursaries; and
- the management of research functions and services in the multiple-campus context.

Regarding the post-merger phase, the Ministry remarked that many of the processes, including those relating to research, would have to be completed before the new council started its work (Department of Education, 2003:45). The Ministry considered research, together with academic planning and quality assurance, as work in progress.

#### 3.3.4 The restructuring of government technikon research funding

From 1994 to 2004, the main research funding issue on government level involved the positioning of research funding structures in terms of the newly implemented philosophy of national co-ordination in such a way that it not only reflected the restructuring process, but also facilitated it. At the same time, government and agency funding for research at technikons, as well as the long history of inequalities between technikon and university subsidy research funding, made ongoing demands on technikon officials. As indicated in Chapter Two, technikon research funding structures were developed as particular needs arose. Therefore, the addressing of funding structures became necessary in order to ensure the successful incorporation of technikons into the new higher education landscape.

As part of the restructuring of research funding, the separation of the government subsidy teaching and research components and the institutional procedures for the allocation of research funding had to be addressed (Foundation for Research Development, 1995). The FRD recommended the separation of the research component from the teaching subsidy component, as well as the direct funding of teaching by the Government. Provision had, however, to be made for research training in the teaching component (Foundation for Research Development, 1995).



The FRD expressed its misgivings as far as "...money which the universities and technikons get for research through their publications, is in most cases not directed towards research at the universities, as no efficient guidelines or mechanisms exist on how these funds should be used" (Foundation for Research Development, 1995:7).

Blankley (1997:1) identified a possible cause for this misdirection of funding, saying that the "...funds are not specifically earmarked for research...[it will therefore depend...on the receiving institutions' own internal policies whether these funds are provided for research..." He added that the accurateness with which the funds were accounted for would depend on the accounting practices of the institutions concerned (Blankley, 1997:3). According to Blankley (1997:1), the new priorities of government had led to the erosion of the strength of public research funds.

In this section, focus is laid on the policy developments impacting on research at technikons. Special reference is paid to the historical inequalities existing between technikon and university subsidy research funding, the alignment of research funding with the co-ordinated national priority system and the dramatic shift in the subsidisation of research output.

(a) The inequalities between technikon and university subsidy research funding

Technikons were noted not only as disadvantaged in terms of research funding, but also in terms of general state funding in comparison to universities (Gihwala, 1995; Haag, 1995). According to Gihwala (1995:69), two areas were especially influenced by such a disadvantage, with the result that the "...lower level of research funding has resulted in a lower level of research culture and thus an inability to build a research infrastructure" at technikons.

Officially, the CTP maintained that "...it was clear that the technikons would for the immediate future remain in a disadvantaged funding position when compared to universities resulting from inequalities in components of the funding formula..." (Lenyai, 1998:5). The Committee added that the situation would "...probably only be addressed after the implementation of the rolling three-year programmes based funding method as proposed in the Green and White papers on HE..." (Lenyai, 1998:5).



The new funding method, as described in the Draft White Paper on Higher Education, was covered in a general section on public expenditure on higher education in South Africa, including details of the goal-oriented public funding, the new funding formula, earmarked funding and the issue of accountability (Department of Education, 1997:2).

The first pertinent point captured in the funding formula was that of the triennial plans of the institutions reporting on planned FTE enrolments and the accompanying DoE funding. The relevant funding would also be announced three years in advance, providing institutions with a predictable basis for planning. In addition, the government funding rates for each FTE student place would "...vary according to the broad field of study and levels of study but... [would] ...be standard for all institutions" (Department of Education, 1997:16,18).

The CTP raised the issue again in the following year, with "[t]he suggested leveling of the playing field with regards to the subsidies...as far as the  $C_1$  values are concerned, ...once again given higher priority by the Executive and Finance Committees" (Figaji, 1999:3, 4). At that stage, the Minister had not yet approved the CTP Finance Committee's recommendation to equate the  $C_1$  values of universities and technikons, but the matter was to receive attention as part of the developments of the new funding formula for higher education that would have an impact on the 1999 allocations (Figaji, 1999:3, 4).

The  $C_1$  values refer to one of the subsidy components provided for in the Department of National Education Policy on government financing of technikons. In terms of the Policy, provision was made for 10 cost units, of which the first cost unit dealt with the government subsidy for instruction/research professionals. This particular cost unit was divided into the following sections: salaries; service bonus; employer's contribution to pension and stabilisation funds; the housing subsidy; and the employer's contribution to the medical aid scheme (Department of National Education, 1989:43–44).

The subsidy components were finalised in the National Plan for Higher Education (2001), as well as in the Policy and Procedures for the measurement of research output (2003), the latter of which was based on the National Plan. The plan acknowledged the presence of inequalities between funding for university research and technikon research, stating that "...research funding is an integral

component of the subsidy for universities (but not for technikons), comprising 15% of the subsidy..." (Department of Education, 2000:72).

Regarding this "blind" component of research funding, the CHE Task Team recommended that "...research resources cannot be dispersed across the full range of institutions...". The Task Team advised that "there should no longer be a 'blind' research funding component but that research should be funded through earmarked funding" (CHE:56 in Department of Education, 2000:74).

In its Technikon Research Development Programme Framework for the period 2002 to 2007, the NRF also referred to the fact that, in spite of being granted degree-awarding powers, the technikons did not receive the "blind" component of research funding that universities received from the Department of Education (National Research Foundation, 2002a:3).

However, the denial of a blind component for research at technikons was faulty. Both the policy documents of 1989 and 1992 refer to the provision that was made for a "blind" component for research undertaken at technikons (Department of National Education, 1992:170). The formula did, indeed, however not generate the same allocation of funding for the research component at technikons as it did for universities. This factor once again highlights the disadvantaged funding position of technikons in relation to universities.

In the National Plan, the Ministry disagreed with the CHE recommendation that the "blind" component "...should be replaced with the funding of research on the basis of earmarked funds" (Department of Education, 2000:75). The Ministry argued that this "would require the production and evaluation of competitive bids linked to business plans, which would be onerous both for institutions and for the Department of Education" (Department of Education, 2000:75). With regard to the blind component for research funding, the Ministry "...agrees with the recommendation of the Council on Higher Education that the 'blind' component for research funding should be separated from the funding formula".

According to the Ministry (Department of Education, 2000:75), "[i]nstitutions are not required to account for the "blind" component. It, therefore results in the inefficient utilisation of resources as not all institutions use the allocated funds to support research...The Ministry is therefore of the view that research funds should be disbursed as a separate component of the new funding formula based, at a minimum, on research and graduate outputs."

The Ministry (Department of Education, 2000:75) emphasised the building of a research capacity and, as a means of attaining this capacity, "...the Ministry is especially keen to encourage inter-institutional collaboration...with specific emphasis on collaboration that enhances research capacity in historically black institutions and technikons".

The Ministry added that the current policies and procedures would be addressed and that "...it is anticipated that the new system will be phased in from the 2002/2003 financial year" (Department of Education, 2000:75). The phasing in referred to the technikons concerned receiving the full C<sup>1</sup> values of the subsidy. The Ministry (Department of Education, 2000:75), however, warned that the building of research capacity should not take place at the cost of the maintenance of current capacity: "The Ministry will therefore allocate earmarked funds to build capacity and to develop potential centres of excellence in research and postgraduate training at the historically black universities and technikons in general."

In the National Plan the Ministry stipulated: "In 2001, R79 million has been allocated for research capacity-building by the National Research Foundation" (Department of Education, 2000:73). In addition, the Ministry added that "[t]he provision of earmarked funds for building research capacity and postgraduate scholarships will be done in collaboration with the National Research Foundation..." (Department of Education, 2000:76). Doing so would "...promote greater co-ordination and efficiency in the allocation of State resources, thus ensuring better value for money" (Department of Education, 2000:76).

(b) The alignment of research funding with the co-ordinated national priority system

Another aspect of technikon and university research funding which became part of the transformation of higher education was the alignment of research funding with national priorities. As early as 1992, NEPI referred to the national co-ordination of research and referred to the FRD study, which stated that "...a final factor contributing to the stagnation of the scientific system in South Africa is the lack of efforts to determine explicit national research priorities" (FRD, 1991:47 in Cloete & Nkhulu, 1992:4).

Apart from highlighting the co-ordination of research on a national basis, NEPI also identified the lack of research co-ordination between post-secondary institutions, industry, and the government at the time (Cloete & Nkhulu, 1992:57).

Such lack of co-ordination was due to the "disturbing increase in South Africa's high-technology trade deficit... [that had] a ...direct and negative effect on the economy and an indirect, but adverse, effect on the PSE system" (Cloete & Nkhulu, 1992:57).

Van Rensburg (1995:13) supported the alignment of research with social priorities: "As far as research funding is concerned, we must move beyond the narrow focus of funding research products...into more challenging areas such as setting priorities for research and research development and coupling scientific and technological goals with societal goals – if we do this, we will establish a new 'contract' between the various participants in research and research related activities and the government."

The FRD also referred to the absence of a system of national research priorities, particularly within the higher education sector, and suggested that South Africa had still to develop research funding priorities (Foundation for Research Development, 1995:31). The development of such research funding priorities would lead to the development of research evaluation programmes that would, in turn, facilitate the channelling of research funding to the most productive research programmes available (Foundation for Research Development, 1995).

Of special note is the fact that the FRD envisaged that "...the evaluation of the performance of institutions of education and research should become an integral part of the transformation of the higher education funding system" (Foundation for Research Development, 1995:5, 6). Blankley (1997) highlighted the seriously defective way in which government research funding had formerly been made available.

The government funding of higher education research had not previously been directed at addressing national development and economic needs. Therefore, although there were national research programmes in existence, the funding awards were made based on the research quality and the track record of the researchers concerned, instead of on that of those researchers doing research in the areas that could most directly improve South Africa's political, social or economic position (Blankley, 1997).

Blankley (1997:1) referred to three very important research funding issues addressed in the White Paper, namely goal-oriented funding, earmarked funding, and accountability, saying that the "...dictates of the economy have a profound

influence on research priorities, policies and sources of funding..." . It, therefore, became necessary that research funding sources from government sources be properly accounted for in line with pre-determined objectives (Blankley, 1997).

Blankley (1997:8) also referred to the proposal made in the White Paper on Science and Technology as to the implementation of a co-ordinated system of grant funding of research in institutions of higher education: "This co-ordinated system would be based on the consolidation of agency functions vested in the various science councils as well as close co-operation with the Department of Education". This proposal eventually materialised with the establishment of the NRF and the subsequent focus area funding framework. In 1997, the position regarding funding for research was elaborated upon in the Draft White Paper on Higher Education.

A number of the issues raised so far, such as the inclusion of the student completions and research publications in the funding grid, received attention in the White Paper (Department of Education, 1997). At the same time, the Government adopted "...a policy of concentration and selectivity in the funding of research and research training" (Department of Education, 1997:21).

The number of places for funded postgraduate students was to be determined by performance indicators of research capacity, competitive success and output by faculty. A positive addition was that the Ministry would "...support and assist the expansion of postgraduate training in those parts of institutions...where there is demonstrable strength" (Department of Education, 1997:21). However, "...earmarked funding will be applied to research capability development and postgraduate training in selected departments at the historically disadvantaged institutions where the research track record has been thin but where there is demonstrable potential to develop and sustain research capacity" (Department of Education, 1997:21).

Blankley (1997:9, 10) mentioned that the draft White Paper on Higher Education referred to the collaborative mechanisms to be put in place between the NRF and the Department of Arts, Culture, Science and Technology, saying that putting such mechanisms in place would lead to the allocation of a much healthier budget for the NRF.

Regarding earmarked funding, the White Paper reported that institutions that wished to apply for funding earmarked for research had to relate such requests to

their strategic plans. The Ministry would, in the process, aim at using the scarce public funds effectively when allocating them to the development of research capability.

The funds should, therefore, "...not be spread across all faculties or schools in all institutions but should rather be concentrated in those areas where there is demonstrable research capacity or potential" (Department of Education, 1997:21). Funding earmarked for research would focus on the preservation and strengthening of existing areas of research excellence, the development of new areas and centres of research excellence, the development of research links with industry and the facilitation of industry-related collaborative research and inter-institutional research collaboration (Department of Education, 1997:21).

Regarding funding, the National Plan said, "The decline in research outputs and capacity and the low postgraduate enrolments are a symptom of a broader problem that plagues the national research system, that is, its continued fragmentation and lack of co-ordination. This is evident, for example, in the fact that there is no nationally integrated information database for research. Furthermore, research funding is fragmented with little or no attempt to co-ordinate funding to ensure that it adds value to research priorities" (Department of Education, 2000:74).

The issue of the evolution of research centres of excellence already formed part of the DoE Policy document Report 024 of 1997, which formulated policy regarding the subsidy to be earned by technikon research output. The issue was subsequently taken still further in the National Plan for Higher Education and, eventually, in the NRF focus area framework. The Department also referred to another dimension of the funding formula, namely the "...extent to which the substructure for research activities...supported by the subsidy formula, is determined by the size of the technikon..." (Department of Education, 1997:4). The Department elaborated on the component of the subsidy related to the research output of a technikon: "Research output... refers to certain published research material. The purpose of introducing a component such as this was to stimulate research at the highest level and thereby to encourage the development of centres of excellence for research at technikons" (Department of Education, 1997:5). Reference was made to centres of excellence in the Draft Education White Paper, as well as in the National Plan for Higher Education released in 2001.

Clearly, the establishment of the NRF focus areas was stimulated by the expounding of such views by the DoE. This point is reminiscent of a point raised earlier in referring to the fact that there was general acceptance of the fact that better control and co-ordination would solve the problems existing in the field of higher education. The holding of such a belief well into the next decade problematised the promotion of a research culture in the technikon sector. Only time could tell whether the focus area programme, in an attempt to align research with the social, political and economic drives of South Africa, indeed successfully stimulated research. Rather, the presence of factors other than sound co-ordination and control is conducive to the development of effectively managed research. The process of research focus areas is discussed in full in the next section.

(c) Output subsidy

One of the most significant differences from the dispensation of the past was that master's and doctoral graduates would now form part of the research output for funding purposes – an issue that had already been mooted in terms of the National Plan. According to the Ministry, the new funding formula for research would include "A separate research component...which will be based on research outputs, including at a minimum, master's and doctoral graduates and research publications, earmarked funds to build research capacity and earmarked funds to facilitate research collaboration (Department of Education, 2000:77).

The National Plan also referred extensively to the issues of research output and productivity, categorically stating that the value and importance of research could not be over-emphasised (Department of Education, 2000:71): "Research, in all its forms and functions, is perhaps the most powerful vehicle that we have to deepen our democracy. Research engenders the values of inquiry, critical thinking, creativity and open-mindedness, which are fundamental to building a strong, democratic ethos in society."

The Ministry also stated that it "...is mindful of the concerns raised by higher education institutions and researchers about the weaknesses and limitations of the current policies and procedures to measure research outputs. These include...insufficient acknowledgement of the distinctive character of research at technikons" (Department of Education, 2000:72).



The National Plan also addressed the shift in focus to strategic and applied research, which had "...clearly been influenced by the increased availability of resources for contract research both from Government and the private sector. This research is often not published in accredited journals or in other formally recognised output measures" (Department of Education, 2000:71). The Ministry expressed its concern about the decline in research output, stating that such a decline "...calls into question the ability of the higher education system to meet the research and development agenda of the country" (Department of Education, 2000:72).

Regarding this, the Ministry said that it would "...attempt to enhance research output and quality through...facilitating the establishment of processes and mechanisms to ensure greater co-ordination in the determination of national research priorities and funding between different State departments, the science councils...[and] the National Research Foundation..." (Department of Education, 2000:77).

The Ministry also addressed the issue of national research priorities, drawing attention to the fact that "...it could be argued that in the absence of a national research plan, there are not clearly defined research priorities" (Department of Education, 2000:74). The urgent need for the development of a national research plan linked to the national system of innovation, that was at the centre of Government's Science and Technology Strategy, was also highlighted (Department of Education, 2000).

In October 2003, the final policy document, titled "Policy and procedures for measurement of research output of public higher education institutions", was published. The policy document included four appendices containing the necessary forms for the submission of books and conference proceedings in order to obtain appropriate unit allocation. While Appendix 3 contained the first- and second-order classification of education subject matter codes, Appendix 4 contained a list of approved South African journals.

The policy that came into effect on 1 January 2005 addressed issues such as recognised research output, including successful submissions to journals, books and published proceedings. Not only were the criteria for recognised research output provided, but the allocation of units and the process and procedures for the submission and evaluation of research output were also explained.



The policy also gave procedural guidelines for how to provide research output to journals, books and proceedings.

### 3.3.5 The restructuring of agency technikon research funding

Government research funding structures were not the only structures transformed during the years under review. The transformation of agency funding structures, such as those of the FRD and the CSD, as well as changes in the handling of issues related to the way in which agency funding operated, reflected changes in government-funding structures. The FRD, as early as 1995, declared its position "that agency funding in this country needs to be consolidated" (Foundation for Research Development, 1995:7). The FRD (1995:7) suggested that "[o]ne way of doing this would be to create a single national body charged with the sole responsibility of funding research in both the natural and social sciences. In this way, public funds for research in higher education institutions could be co-ordinated and rationalised, research could be better integrated." Once again, the belief in the value of co-ordination and control was prominent.

#### (a) The establishment of the NRF

The NRF, in its Technikon Research Development Programme Framework for 2002 to 2007, described the integration of the former FRD and the CSD. Both the former CSD, as well as the FRD, recognised the necessity for designing and putting in place a support programme dedicated to the development of research at technikons. The concept of dedicated support for technikons being provided by both the CSD and the FRD "...dates back as far as 1990 when the FRD started its first Technikon Programme. The CSD's equivalent programme was launched in 1995..." (National Research Foundation, 2002a:2).

Blankley (1997:9) referred to the implications of the NRF Bill for research funding. "At present it appears that only the agency functions of the HSRC (i.e. the...CSD and...the FRD) will be amalgamated". Furthermore, the tendency to move away from funding based on the four disciplines could prove to be problematic, as the "...prescriptive disciplinary divisions proposed in the White Paper remain entrenched in the Bill..." (Blankley, 1997:9). However, at the same time an opportunity was presented for "...organisations such as government departments which would prefer to see their research funds directed through a particular division rather than being channelled through different programmes" (Blankley, 1997:9).

In 2000, the NRF published regulations replacing all previous publications and circulars regarding master's and doctoral scholarships and research grants at technikons. In its publication, the NRF commented that the President of South Africa created the NRF by the Act of Parliament No 23 of 1998. "This organisation was to replace the Foundation for Research Development...and the funding agency of the Human Sciences Research Council, the Centre for Science Development..." (National Research Foundation, 2000a:1). After the NRF was established in April 1999, the organisation was involved in adjusting its programmes and structures to subscribe to a new, broader mission (National Research Foundation, 2000a:1).

In its 2002 manual, the NRF supplied a brief background to the evolution of the CSD and the Foundation for Research Development. The previously existing CSD had funded humanities and social sciences research predominantly on an individual basis, and had promoted scholarship in order to establish a base of research activity at the technikons. The FRD, the programme for the natural sciences, engineering and technology, had implemented a focused approach to the building of research capacity in specific areas (Activity Areas) at each technikon (National Research Foundation, 2002:4).

(b) The establishment of the NRF Technikon Research Development Programme

In July 1995, the FRD started to conceptualise the Technikon Research Development Programme. According to the Foundation (Foundation for Research Development, 1995:2), the programme was to "...be created with the mandate of creating a vibrant, creative, innovative and sustainable research environment at technikons".

The mission of the Social Sciences and Humanities Technikon Research Development Programme included the development of a research culture and the building of research capacity at technikons (National Research Foundation, 2000a:2). The NRF also mentioned its endeavour "...to create a separate programme to address the specific research development needs of the technikons" (National Research Foundation, 2000:2). The objectives included assistance "...in the creation of a research culture at all technikons to enable them to participate fully in the reconstruction and development of the country" (National Research Foundation, 2000a:2).

sustain and enhance their research efforts, to develop a critical mass of researchers in their identified R&D Niche Areas and to promote at institutional and national level the recognition of research" (National Research Foundation, 2002:4). The programme had three core objectives: the strengthening of participation between technikons within the National System of Innovation, the ensuring of sustainable development of R&D at technikons and the acceleration of the movement of technikon researchers into the mainstream of national and other support (National Research Foundation, 2002). The NRF dedicated the year 2002 to the development of provisionally approved R&D Niche Areas to a point where they could be evaluated by the NRF Evaluation Centre (National Research Foundation, 2002c:16).

(c) The establishment of research priorities and the focus area funding framework

The NRF acknowledged the fact that the development of niche areas in most instances was new to researchers active in the social sciences and humanities. The Foundation therefore determined to devote special attention to these groups of people. The NRF also acknowledged the fact that they would have to be proactive and provide each activity area with more sustained funding (National Research Foundation, 2002c:16).

The NRF provided for technikons to continue to identify and develop R&D niche areas, since the development of research at technikons was still very much part of a dynamic process (National Research Foundation, 2002c). The NRF, however, acknowledged that such endeavours would only "...be able to be supported within the resource limitations that exist...". The NRF therefore strongly urged technikons to "...consolidate their research efforts into a limited number of R&D Niche Areas" (National Research Foundation, 2002c:16).

In addition to the above approach, the NRF acknowledged the presence of technikon-based individual researchers "...who show potential or who have excellent ideas that fall outside the approved R&D Niche Areas of her/his technikon" (National Research Foundation, 2002c:6–7). These researchers would be encouraged to adapt their research projects to fall within the scope of an R&D Niche Area" (National Research Foundation, 2002c:6–7).

### 3.3.6 A new approach to quality assurance

During the early years of investigation into the unified higher education system, Jacobs (1996:10, 11) reported on the new approach to quality: "The mechanisms

of academic audit at institutional level and quality assessment at programme level may have to be integrated into a new approach...". Such a new approach, according to Jacobs (1996), would depend on whether the Minister of Education accepted the recommendations of the National Commission for Higher Education, as well as on the requirements of the future South African Qualifications Authority. SERTEC believed that it put the necessary measures in place for the monitoring of quality in higher education in South Africa..." (Jacobs, 1996:10, 11).

With regard to expertise and the support of the Minister, Jacobs (1996:10, 11) wrote, "The Council has developed a reasonable amount of operational quality monitoring expertise and it intends making such expertise available to the South African Qualifications Authority and to any sub-system of institutions that wish to benefit there from. The Council enjoys the support of the Minister of Education, as was demonstrated in the appointment of a new Council for a further period of four years."

Jacobs (1996:10, 11) also pointed out the danger of re-inventing the wheel: "The Council believes that a termination of its activities in favour of the establishment of another similar body, will amount to the re-invention of the wheel in quality monitoring in the career oriented higher education institutions." According to Jacobs (2000:73), it was clear that the Higher Education Quality Committee would have to perform the function of assuring quality in both the university and the technikon sectors. "The (Higher Education) Act (Act No. 101 of 1997) stipulated that the aim of the establishment of a Higher Education Quality Committee (HEQC) by the CHE was to improve quality; to do institutional audits; and to assess programme quality and accredit such programmes...The CHE will register with SAQA as an Education and Training Quality Assurance Body. Should the CHE also advise the Minister, the SERTEC Act may be repealed and all its activities transferred to the HEQC."

The CHE (2000:35) Task Team addressed a few "...critical outcomes that are strongly related to achieving quality in higher education...[and said] ...the range of programmes and qualifications that an institution should offer through focused institutional mandates and specific missions must be identified...This would concentrate attention, energy and resources on a more limited range of purposes and outcomes...Quality assurance can then target programme improvement in a strategic way within single or across multiple institutions."

The CHE (2000) was of the view that it, in the light of limited financial resources and the small number of academic staff with postgraduate qualifications, did not make sense, from a quality assurance point of view, that all the HEIs should offer doctoral – or even master's qualifications – in all fields.

### 3.4 CONCLUSION

This chapter focused on the restructuring of higher education, from the first policy Investigations and attempts made by the Department of National Education, in 1991, to the NEPI investigation, in 1992, to the later analysis of the anticipated developments by the CHE Task Team, the NWG and a number of government policies and plans.

Understanding the purpose of including the somewhat elaborate and sometimes very detailed exposition of the unfolding of the restructuring process is important. Although the focus of the chapter was on the restructuring of higher education, the purpose of the discussion was not only to provide an accurate description of the context in which technikons found themselves over the recent years, but also to illuminate the impact that these changes had on the development of research at technikons.

One recurring theme time and again prominently presented itself in the multitude of reports and documents: the continuously-mentioned desire for national central control and co-ordination. This process the technikons could not, and did not, escape.

To what extent the technikon sector, headed by the Committee of Technikon Principals, could be seen as being united in its drive to change from the former diploma-based career education to one that was degree- and research-based is unknown. The fact of the matter is that technikons no longer existed at the time of completion of this study. Universities of Technology had been established in their place, with the new type of institution having to meet the same research expectations and requirements as those of the basic universities, because they both participated in a restructured, unified university-based higher education landscape, rationalised by the government of the day.

The issue at hand was whether the UoTs could meet this challenge and whether pursuing the research drive to the possible detriment of the crucial contribution they could possibly make towards the development of technological human

resources, by confining developments to those in the technological higher degree structure, was worth their while.

The birth of and journey that research and Universities of Technology travelled was along a process starting with the Mechanics Institutes offering practical training to support workplace training offered to apprentices in the railways and mines. Out of this the Trades Schools were established by the Department of Education to enhance the theoretical component of the training, formalise the training as well as provide trades training during the day. Trades Schools gave birth to technical institutes offering vocational education at a level higher than the secondary level and this led to the establishment of technical high schools.

The technical institutes that were willing to close their high school divisions and stop offering work at the secondary level were declared technical colleges and were given higher education status. To advance the image of the colleges and finally rid them from their association with apprenticeship training, the colleges were redesignated as Colleges for Advanced Technical Education offering vocational and technical education at the tertiary level. This development led to a further redesignation of the colleges as technikons and the research-based fifth- and sixth-year vocational diploma qualifications were added to the hierarchy of qualifications. From here the possibility of post-graduate vocational degrees became a considered reality. The process of restructuring the South African higher education model captivated the minds of the Committee of Technikon to such an extent that it led to the establishment of Universities of Technology offering technical education so advanced that the education offered at this level is classified as technological of nature.

## **CHAPTER FOUR**

### **THE VISION, STRATEGIES AND PLANS FOR THE ESTABLISHMENT OF A RESEARCH CULTURE AT TECHNIKONS**

## CHAPTER FOUR

### THE VISION, STRATEGIES AND PLANS FOR THE ESTABLISHMENT OF A RESEARCH CULTURE AT TECHNIKONS

	PAGE
4.1 INTRODUCTION	155
4.2 THE GOVERNMENT'S PHILOSOPHY FOR TECHNIKON EDUCATION	156
4.3 THE CTP'S VISION FOR A RESEARCH CULTURE AT TECHNIKONS	158
4.3.1 The Research Philosophy for technikon education	158
4.3.2 The Research Philosophy for technikons in South Africa	161
4.3.3 The implementation of research and development programmes	165
4.3.4 Concluding remarks	167
4.4 THE INTRODUCTION OF RESEARCH FOR STAFF DEVELOPMENT	167
4.4.1 The transformation of the teaching culture	169
4.4.2 Staff research capacity	176
4.4.3 Concluding remarks	181
4.5 THE TYPE, FOCUS AND ORIENTATION OF RESEARCH AT TECHNIKONS	182
4.5.1 Industry innovation and problem solving	184
4.5.2 The technological nature of technikon education	185
4.5.3 Technikon research and technology transfer	186
4.5.4 Concluding remarks	189
4.6 THE PROVISION OF TECHNOLOGISTS	189
4.6.1 Acceptance of technikon student research	190
4.6.2 The creation of confidence in the technikon advanced diploma	191
4.6.3 The technological higher degree and research at technikons	193
4.6.4 Concluding remarks	196
4.7 CONCLUSION	198



## CHAPTER FOUR

### THE VISION, STRATEGIES AND PLANS FOR THE ESTABLISHMENT OF A RESEARCH CULTURE AT TECHNIKONS

#### 4.1 INTRODUCTION

Chapter Two of my thesis dealt with the history of technical higher education, including the developments related to research during each of the periods identified from the 1960s to the early 1990s. These developments included the extension of the qualification structure of the technical colleges in 1963 to include a fourth year and the 'upgrading' of the technical colleges to CATES in 1967. In 1979, the CATES were redesignated technikons and in 1981 the qualification structure was again extended to include a fifth-year, as well as a sixth-year, qualification. It was also envisaged at the time that research would be instrumental in distinguishing the CATES from the former technical colleges. The above strategies and plans were the earliest indicators of the desire to establish a research culture at technikons.

During the 1970s, the Colleges and the Department of National Education experienced a difference in view regarding the participation of students in research. On the one hand, consideration was given by the college officials in 1967 (Beukes, 1984) to the desirability of the direct involvement of staff and students in research in the establishment of the CATES. On the other hand, the Department of National Education, in spite of the fact that it approved the concept of building qualifications from a mere three-year diploma in technology to that of a five-year diploma in the same, in 1977 decided that student research would not, after all, form part of higher qualification studies. The Department did, however, accept the research function of technikons in 1979 (Pittendrigh, 1988).

In 1981, progress was made with student research when the apprenticeship and technician courses (consisting of both national diplomas and national higher diplomas) were finally formally separated. The technician course became the fourth-year technikon qualification, while the fifth-year Diploma in Technology and the sixth-year Associate of the

Institute of Technology qualification were introduced. These developments, fully discussed in Chapter Two, came about mainly as a result of the insights provided by the Goode Commission.

As far as the growing recognition of the place and role of research at technikons is concerned, the following two developments, which both took place in 1981, are noteworthy. The first was the aforementioned separation of the fourth year from the 'sandwich' course, in effect forming an additional separate fourth-year NHD, with the second being the addition of levels 5 and 6 to the qualification structure. Both these qualifications were based on the successful submission of a thesis, project or design. These two qualifications were envisaged as being capable of supplying the country with high-level skilled technologists, much needed by South African industries. At the same time, according to Van Rensburg (1985:9), research was officially introduced at technikons in the form of these two qualifications.

The focus of the current chapter is on the development of the research culture at technikons during the late 1980s and the 1990s. The discussion addresses the establishment of a research culture by means of the addition of advanced qualifications aimed at developing staff and providing the country with an adequate supply of technologists. The establishment of this culture led to technikon research taking on a unique role and function in regard to the provision of technologists with reference to a specific type, focus and orientation of research at technikons, which also comes under discussion.

#### 4.2 THE GOVERNMENT'S PHILOSOPHY FOR TECHNIKON EDUCATION

In July 1988, nearly a decade after the inception of technikons in South Africa, the Department of National Education published a key document entitled *A Philosophy for Technikon Education*. Only two pages of the 52-page document are devoted to a description of research at technikons. In this respect, the document states as follows: "While research means the discovery of new knowledge or the development of new technology, the technikon is mainly concerned with solving problems in industry"

(Department of National Education, 1988:51). This view firmly aligns technikon research with the needs of its main stakeholder group, industry and the essentially problem-solving nature. In this regard the Department pointed out that the "...main goal of technikon research is not publication in scientific journals" (Department of National Education, 1988:51).

The Department further justifies the presence of industry-oriented/applied research at technikons, saying that basic research is not "...reconcilable with the concrete technological orientation which emerges from the...philosophy regarding technikons" (Department of National Education, 1988:51).

Already at this early stage the department described the profile of the lecturer responsible for supervising student research at technikons: "The lecturer must himself have experience of problem-solving research to be able to convey the secret of applied research to his students" (Department of National Education, 1988:51). The department emphasised the value of research for improving the relationship of technikons with industry and for the development of both lecturing staff and students (Department of National Education, 1988).

Brief reference has already been made to the opposing views of the government's education department and the CTP regarding research. The next section provides a full exposition of the CTP's vision, as expressed in 1989, for establishing a research culture at technikons, which amounts to the first official philosophy statement made on the position of research at technikons. In the same year, the education department formulated national policy on the government financing of technikons.

Research-related policy developments during the 1990s included the NATED 02-236 (92/11), which embodied the policy on the revised subsidy formula for technikons. In 1993, the Technikon Act No. 125, which officially mandated technikons to offer research-based degrees, was promulgated.

In 1994, the CTP published a document titled *A Framework for the introduction of degrees at technikons*. After the amendment of the

Technikon Act No. 27, the degree qualification structure was implemented in 1995. Three years later, in 1998, the Committee published a revised research philosophy while, in 1999, it implemented the *Guidelines for the implementation of research and development programmes at technikons*. All these developments took place within the context of the restructuring of South African higher education, which makes it understandable that research at technikons could not escape the impact of restructuring.

#### 4.3 THE CTP'S VISION FOR A RESEARCH CULTURE AT TECHNIKONS

##### 4.3.1 The Research Philosophy for technikon education

Only one year after the Department's Philosophy for Technikon Education, the Committee of Technikon Principals published its document entitled *A Research Philosophy for Technikon Education*, in which the Committee describes the role and function of research undertaken at technikons (CTP, 1989). The CTP mainly addressed the reason for introducing research at technikons, which was the enhancement of the education and training function of technikons. By this, the CTP meant the enhancement of the technikons' ability to provide South Africa with technological human resources.

At the same time, an avenue was provided for technikon staff to develop themselves by improving their qualifications and their ability to supervise technikon research. The CTP elaborated on the nature of technikon research, supporting the government's desire to further the alignment of technikon research with industrial needs.

As already mentioned, according to the CTP, the first reason for the introduction of research at the technikons was to enhance their educational and training function. The improvement of the educational and training function of technikons became necessary in light of the fact that technikons had to address South Africa's industrial productivity, economic competitiveness and the inability of South Africa to enter the industrial export market. The need to supply the labour market with high-level technologically-skilled human resources became increasingly evident as

the ability to think on a level necessary for innovative product development became ever more apparent. The introduction of higher technological qualifications was envisaged as enabling the achievement of this aim.

Related to the aforementioned reason for introducing research at technikons in order to enhance their education and training function was the need to equip staff with the ability to provide research support for students enrolled for higher technological qualifications. Such a move was necessary to enable technikons to produce the required technologically-skilled human resources (CTP, 1989).

The need for the technikon sector to address South Africa's industrial competitive situation was often reiterated at the time. According to CTP (1989) South Africa's inability to enter the export market for manufactured goods was largely the result of the lack of necessary skilled human resources in the technical and engineering fields. This absence of technical and engineering skills led to two problems, namely low productivity and "...the inability to produce new products through applied and product-oriented research and development" (CTP, 1989:1) According to the CTP, the "...responsibility for innovative action..." would be found in the high level of technologically skilled manpower that the South African manufacturing sector of the economy lacked.

In order to support their initiatives in regards to advancing research at technikons, the Committee referred to two prominent national documents. The first document was the Scientific Policy and Development Programme for South Africa, which promoted the active advancement of the extension of research at technikons, particularly those technikons that demonstrated a potential to do research (Department of Constitutional Development and Planning (1982:19) in CTP, 1989:2). The second was the Policy for Technological Innovation for South Africa, also referring to the need for "...purposeful planning for greater interaction between industries and research organisations...including...technikons..." (NATED, 11-002 (87/02:6) in CTP, 1989:2).

The CTP (1989:3) further motivated for the advancement of research at technikons by referring to speeches made by two prominent government officials. The first was the speech made by the then State President, P.W. Botha, during the opening of the engineering complex of the Technikon Pretoria in June 1987. In his speech, Botha specifically referred to "...the role of technikons in research and development as well as their contribution towards making [South Africa] self-sufficient and independent of overseas manufacturers...". The second was the speech by Minister Viljoen during the official opening of the Technikon Northern Transvaal. In his speech, Viljoen highlighted that research "...at the technikon, through regular contact with the private sector, must be primarily concerned with the solving of problems in industry" (CTP, 1989:3).

The second reason for introducing research at technikons was that the specific nature of technikon research would promote the practice of technology, meaning the systematic activity of utilising existing scientific knowledge in commerce and industry (CTP, 1989). The knowledge, acquired by way of the conducting of applied research, would therefore be utilised to design, evaluate and adapt services, processes and/or systems and materials, products or appliances. Such developments would then be implemented in practice, used for manufacturing or harnessed for the improvement of performance in general (CTP, 1989). The CTP continuously emphasised that although technikon research is education and training-oriented, it, nevertheless, focuses on marketable product development (CTP, 1989:7, 8).

The CTP explained that the practice of technology covers not only the natural sciences and engineering fields, but also those of the humanities and management. The CTP needed to clarify this issue, due to the assumption that "...researchers in technology will limit themselves to mainly technological problems..." (CTP, 1989:6). This assumption, according to the CTP, related to the operational needs of industry. Operational problems, in most cases, require quick responses from researchers and the "...approach of waiting for new inputs from pure science in order to solve the problem would simply be invalidated by the deadlines prevailing in that

industrial sector” (CTP, 1989:6). Industry requires quick problem-solving solutions and technikon research, because of its essentially applied nature, is in a unique position to satisfy the demands of industry within set time limits (CTP, 1989:6).

The above discussion highlights the tremendous value of technikon research for industry due essentially to its applied nature. The technikon’s orientation towards applied research, according to the CTP, arises from the vocational character underlying all training and tuition (CTP, 1989:4). As a result, the purpose of advancing the qualification structure was to supply the labour market with technologists, who would operate as the ‘thinkers within the technology’.

Technologists would not only be skilled in identifying industry problems, but would “...be conversant with research methodologies that are part and parcel of problem-solving in industry” (CTP, 1989:4). The CTP envisaged that the introduction of research at technikons would address the relative shortage of, and imbalance between, basic research on the one hand and applied research and development on the other. Such a need would be satisfied by way of the training of technology researchers.

#### 4.3.2 The Research Philosophy for technikons in South Africa

In 1998, nearly 10 years after the publication of the first research philosophy and four years into the new democratic dispensation, the CTP published a revised Research Philosophy for Technikons. The main aim of this document was not so much to clarify the role of research in technikon education, but to highlight the contribution that technikons could make to research and development in the new South Africa. According to the CTP (1998:7), a research philosophy for technikons would be instrumental in identifying “...the research strengths, capabilities and capacities of the individual technikons and [the relation of] these aspects to the needs of the end-users, [namely] industry, commerce, government and the community”. The type of research to be conducted at technikons had to be

“...appropriate and applied...in order to contribute to the economic growth and social development and reconstruction of South Africa” (CTP, 1998:3).

The points raised by the CTP demonstrated its view that not only research in general, but especially research at technikons should be aligned with the social, economic and political purposes of transforming South Africa. It became necessary for technikons to do research that would be of relevance to the broader South African society. The CTP was of the opinion that technikon research, because of its applied nature, would be in an ideal position to adhere to the requirement of social relevance.

In its revised document, the CTP referred to the former policy environment that had denied technikons the possibility of developing a research culture. The Committee saw the Technikon Act No. 125 of 1993 as a significant contributor to the development of technikons as research institutions, as it authorised technikons to offer degrees. The CTP, however, wanted the technikons to understand that, in order to be able to play a significant role in research and development, it would be necessary to have a well-developed research and development capacity (CTP, 1998:6).

This is the first time that the CTP explicitly referred to the necessity of the development of a research capacity and a research culture at technikons. The Committee continued its discussion on this point in the document entitled *Guidelines for the development of research and development programmes at technikons*, published in 1999.

One of the reasons for the development of research capacity was that those staff who were expected to educate and train technikon students in research and development had to be “...experts within certain disciplines of science and technology” (CTP, 1998:6). The building of the technikon staff's capacity to do research was essential to the development of technikon students in the fields of science and technology.

The 1998 Research Philosophy addressed the research challenges that lay in wait for the technikons, the principles that should guide research developments, and the research and development transformational



objectives. The first research challenge for technikons was that their research and development activities should enhance their research potential in regard to producing utilisable results and products. Resultly, two components of technikon research would display the true characteristic of technikon research, namely the transfer and diffusion of expertise and technology and the successful implementation of results. These two components would therefore form an integral part of the technikons' approach to research and development.

The task of technikons essentially was seen to involve the practice of technology. The CTP argued that the practice of technology had its "...origin in the application of practical, useful outcomes of existing scientific knowledge in order to solve a given practical problem" (CTP, 1998:4, 5). The reaffirmation was once again made that such application not only referred to the science and engineering fields, but also to those of the humanities and management.

The CTP acknowledged that technikons would be challenged by the South African economy that was becoming increasingly technology-oriented. It recognised that such a challenge would require the harnessing of different types of skills and capabilities in order to maximise the development and application of the new technologies. In line with this recognition, the CTP referred to the methodological changes brought about in the production of knowledge as a result of the information revolution (CTP, 1998).

The new Philosophy document also provided a framework of principles for the development of research at technikons. The principles related mainly to research capacity building, the role of research in the lives of academics and the necessity for quality research to be conducted by technikons. Firstly, technikons were to embark on serious capacity-building endeavours. The CTP described these endeavours as including the correction of past imbalances, staff development specifically aimed at increasing the number of staff with postgraduate qualifications and the provision, maintenance and modernisation of research infrastructure (CTP, 1998:8,9)

Other issues covered were the need to increase the supply of postgraduates to identified priority and focus areas, the promotion of interdisciplinary research and development, and the need to collaborate in regard to regional, national and international research and development (CTP, 1998:8, 9). This view supports the comment made earlier regarding the extent to which technikons took note of the national discourse regarding the new requirements that South African research, especially technikon research, had to meet.

Secondly the CTP suggested that research and development should play an important role in the lives of all academic staff members. Research and lecturing should complement each other, with senior management being committed to the promotion of research and development activities. The CTP therefore took a particular stance regarding the positioning of research at technikons, namely that research and teaching should receive equal attention.

Thirdly, all research and development would have, in addition to meeting recognised local and international standards, to be based on the principles of sustainability, quality, relevance, competitiveness and entrepreneurship and research and development. Research and development activities should be undertaken increasingly in partnership with government departments, research councils, commerce and industry, and the community, as well as with other HEIs (CTP, 1998).

The CTP also included a number of transformational objectives in the new philosophy statement. The objectives had to be achieved in order to ensure the application of the above-mentioned principles, if technikons wanted to meet the aforementioned challenges.

The CTP (1998:10) proposed a number of strategies to transform the teaching culture, including:

- the building of an appropriate research climate, base, infrastructure and support system;

- the development of research and development excellence in identified priority areas;
- the development of networks of excellence and the establishment of necessary critical mass of expertise;
- a focusing of research and development activities on applied, product and process-related research and the development of related research capacity;
- the ensuring of top-quality contributions to the reconstruction and development of South Africa by means of the R&D activities undertaken by both staff and students and the making of a specific contribution to the development of the SMME (small, medium and macro enterprises) sector by the addressing of its specific R&D needs; and
- the development of research capacity by means of directed staff training and development.

The CTP reiterated that the research undertaken at technikons should address the relative shortage of technology researchers and the existing imbalance between basic and applied research (CTP, 1998:3, 6). As previously mentioned, one of the transformational objectives of the 1998 CTP Research Philosophy was to build and develop research excellence in identified research priority areas.

The CTP felt so strongly about this issue, realising that for this initiative to be successful, it had to be institutionalised. To provide South African technikons with an instrument by which to achieve this purpose, in 1999, the Committee published a document entitled *Guidelines for the implementation of research and development programmes at technikons*. Whereas the Philosophy document appears to be more of a policy and vision statement, the latter document attempted to provide more concrete operational guidelines for the sector.

#### 4.3.3 The implementation of research and development programmes

The *Guidelines for the implementation for research and development programmes at technikons* focused on the development of operational

plans to stimulate research and development programmes at technikons and outlined a number of strategies and mechanisms to empower technikons to "[further]...the research and development capabilities and capacities" (CTP, 1999:1, 2). The CTP suggested that the research culture would be successfully established by launching research and development programmes, developing research focus areas and promoting research and development (CTP, 1999).

The technikons needed to address a number of different issues when developing research and development programmes, including the need for a vision and mission for the research and development programme, which would spell out the objectives for the development of staff and students, as well as provide the overall framework for capacity building, research culture and outputs. Management should also display commitment and ownership of research development, providing the necessary research and development structures.

In order to initiate the research and development programmes, the technikons would have to perform an analysis of the existing strengths, weaknesses, opportunities and threats in order to position the institution in terms of research. The technikons would also have to co-operate and form partnerships on a regional basis. Lastly, the technikons should start developing research focus areas (CTP, 1999).

The CTP further suggested that business plans should be drawn up for the establishment of such focus areas. These plans would typically have to include the following components: the title of the research focus area; the rationale and motivation for the focus area; background information relating to the technikons; the objectives of the focus area; the research methodology for the type of research envisaged in the area; the regional collaboration and partnerships; and the envisaged projects, quantitative outputs and funding requirements (CTP, 1998:10–13).

#### 4.3.4 Concluding remarks

The documents discussed in this section show how the CTP, over time, systematically attempted to clarify the role as well as to explain the necessity of introducing research at technikons. It was especially necessary to distinguish the role of technikon research from that of university research, as well as to distinguish the educational role of technikons from that of technical colleges. From the 1989 Research Philosophy document, it is clear that, for the CTP, the focus of technikon research was not so much to be on the generation of scientific knowledge, but rather on the practice of technology and the application of knowledge in industry.

The following aspects indicated that research should be primarily applied and technological: the vocational nature of technikon education; the focus of technikon research on the utilisation of knowledge, with the aim of applying the knowledge to the implementation of processes, products and services and the improvement of industrial performance; and the orientation of research towards meeting a predetermined goal.

The 1998 Research Philosophy and the 1999 *Guidelines for the implementation of research and development programmes at technikons* also provided the CTP with an opportune platform for publishing its position as regards the envisaged development in the role of technikons from that of serving merely as practitioners of technology to that of being transferors of technology.

#### 4.4 THE INTRODUCTION OF RESEARCH FOR STAFF DEVELOPMENT

The CTP stated in its Research Philosophy that the essential focus of research and development activities at technikons was to build the research capacity of staff as a general staff development initiative aimed at increasing the number of staff with postgraduate qualifications. The CTP argued that staff would have to be capacitated to do research if the technikons were to provide the South African labour market with much-needed technologically-skilled human resources.

The 1989 Research Philosophy for technikon education mentioned that technikon staff who instructed students on the M Dip Tech and Laureatus levels should be skilled technology researchers. Such a requirement would enable the staff concerned to transfer the necessary research skills and methodologies to the postgraduate students, who would then be empowered, on graduating with either of these two qualifications, both to identify industry problems and to be able to solve context-specific problems (CTP, 1989). This meant that the technikons would ideally produce graduates who were familiar with industrial problem-solving research methodologies.

The CTP raised this issue again in its revised Philosophy for Research at Technikons, arguing that the Technikon Act No. 125 of 1993 opened the way for technikons to establish an appropriate research culture. Such authorisation created a new awareness of the importance of developing an adequate research and development capacity at technikons. The staff concerned, who were expected to educate and train students in research and development (CTP, 1998), therefore, themselves, had to be skilled science and technology researchers.

Two of the principles relating to the development of research at technikons in terms of the 1998 Research Philosophy refer directly to those staff involved in such development. The first principle related to capacity building, by which the CTP meant staff development. By launching such a staff development initiative, the Committee aimed to increase the number of staff in possession of postgraduate qualifications. The second principle with direct reference to staff stressed the importance of research and development taking a prominent position in the spectrum of activities of academic staff members.

In addition to the principles for the development of research, as outlined in the Philosophy, the CTP (1998:10) listed a number of transformational research objectives to be achieved by technikons, one of which referred specifically to staff. The objective concerned stated that the pure teaching culture of the past should transform into a culture that also embraced

learning and research. Such transformation, according to the CTP, should be achieved by means of appropriate staff training. Therefore, no doubt exists that the CTP required of staff employed at technikons that they be able to do research, as well as to supervise student research and teach. The real challenge for the technikons lay in putting this vision of doing research at technikons into practice. Chapter 5 shows the statistical reality of this part of the CTP vision.

The following section addresses two factors impacting on the success of the introduction of research for staff development, namely the desire of the CTP to transform the teaching culture and the initiative shown by the CTP in striving to motivate the building up of the research capacity of technikon staff.

#### 4.4.1 The transformation of the teaching culture

Technikons have traditionally been teaching institutions. The CTP expressed the hope that the Technikons Act No. 125 of 1993 would so contribute to the transformation of the teaching culture that the academic culture at technikons would come to include a culture of research.

Such was, however, only the beginning of the process aimed at transforming the teaching culture and a number of practical implications relating to the implementation of the process challenged the successful progression of the transformation process.

This discussion first highlights the challenges faced by technikons in transforming the academic culture to one inclusive of both teaching and research. Secondly, a number of suggestions are made as to how institutions could transform the teaching culture and, thirdly, the practicalities of convincing or incentivising staff to do research are discussed.

The first challenge that the technikons faced in transforming the teaching culture was to convince staff of the value of research for teaching.

According to Fransman (2000:12), the staff questioned the contribution that research would make to the improvement of their teaching.

Those who, in the past, have argued for the value of research for teaching, have also tended to highlight the fact that high teaching loads and administrative and other demands made on technikon lecturers inhibit research progress and productivity.

The main arguments in favour of the view of preserving teaching and research unity are that research both improves teaching practice and also promotes effective learning. that research assists staff in the process of learning and intellectual development; that research transforms the whole approach to learning by creating a climate conducive to research; that research ensures authoritative teaching with a vocational focus; and that research is of value for teaching, as it puts the lecturer in the role of the learner (Committee of Technikon Principals, 1998:8; Du Toit and Van der Wal, 1994:94; Fransman, 2000:12; FRD, 1995:2; Gihwala, 1992:22; Gihwala, 1995:68).

Maharaj (1998:1) stresses the significance of the relationship between teaching and research: "The significance and relationship between research and teaching/learning in a higher education environment is similar to that of 'heat to fire'...one cannot exist without the other". Such an affirmation soundly demonstrates the value attached to research as an enhancer of teaching practice.

For most of the 1980s, sound teaching practice was emphasised at technikons for the role that it played in making diplomates more employable. The belief that the unity between teaching and research, especially within one institution, should be maintained is most markedly not a universal one. Such researchers as Cloete and Nkhulu (1992) and Martin (2003) refer to countries like Japan, the former Soviet Union, Sweden, France and Germany that clearly distinguish teaching from learning in their research institutions.



Martin (2003), though indicating that the maintenance of research and teaching unity could be of benefit at the undergraduate level, nevertheless points out that combining research with teaching in an HEI is not essential. Many overseas universities deliberately chose either to become research universities or to remain teaching universities.

The source of views in favour of retaining the research and teaching unity was predominantly academics in the technikon sector. Such views provided sufficient evidence to establish the belief among technikon officials that research was of value of teaching. These views, as well as the claim that high teaching loads prevented research progress, were, however, not substantially based on empirical evidence.

However, one available empirical study was the study done by the FRD in 1996. The FRD study, in its empirical results, reflected the actual amount of time that technikon staff had available for research, based on findings involving both staff and students from the Science and Technology faculties of the Pretoria Technikon, the Port Elizabeth Technikon, the Cape Technikon and the Peninsula Technikon. In response to the statement, "The teaching load of academic staff allows them sufficient time to engage in quality research", the following was reported:

TABLE 5: FRD STUDY FINDINGS

1	2	3	4	5
Strongly disagree	Tend to disagree	Neither agree nor disagree	Tend to agree	Strongly agree
44%	22%	11%	13%	4%

The remaining 5% of the respondents did not express an opinion regarding this statement. Only 4% of the respondents strongly agreed that the teaching load of staff allowed them sufficient time to engage in quality research, while a significant 44% strongly disagreed that they had sufficient time for such research.

A more recent view of the impact of teaching loads on the development of research emanates from a study done by Winberg (2005), in which he involved staff members employed at the recently established UoTs.

He reported as follows: "The high teaching loads (inherited from the school model) remain, making time to do fieldwork or laboratory work and to write up research findings difficult" (2005:195). In spite of insufficient evidence to support the maintenance of the concept of research-teaching unity, the technikons sector embarked on a conscious effort to accommodate research within the academic culture at technikons. Winberg (2005) referred to their endeavours as a process of "imitating the universities". To successfully achieve such an accommodation, the teaching culture had to be transformed. The question was: How should this be done?

Fransman (2000:8, 9), suggesting a possible way forward, urged that research "...must enjoy the profile comparable to other programmes at the institution...". In terms of this statement, the same value that was attached to other activities at the time should be attached to research. Ramchander (2000) similarly argued that, because research enriches teaching, no dichotomy should exist between the two. Research and teaching should neither be in opposition to each other, nor should there be any clear defining lines between them, because research and teaching are overlapping activities that should effectively complement each other. Lastly, at the technikon level, the unity of teaching and research should be maintained by means of their integration.

Ramchander (2000:16), despite acknowledging the value of research for the training of students, also warned that it would be "...unfortunate if a higher premium were placed on research than on teaching at technikons...". Emphasising research to the detriment of teaching was therefore not what the technikons wanted (Shippey, 1987; Van Rensburg, 1995).

Technikons were then faced with the challenge of transforming the teaching culture. In order to successfully implement such a process, the technikons needed to clearly define the place of research within their establishments and to identify the role of teaching, as well as of research. Taylor (2001) suggested that such clarification could be achieved by means of publishing a research mission statement.

The absence of such a research mission statement might otherwise lead to the perception that sound teaching practice was being sacrificed to the so-called 'greater good' of research.

The research mission statement is important, as it encapsulates the research aims of a particular institution, avoiding, in principle, any uncertainties regarding the institutional mandate and supplying a frame of reference within which staff could allocate sufficient time and effort to both teaching and research. Such a mission statement would provide both staff and students with clear direction regarding the aims of the institution, and hence also enable the public, as the ultimate receiver of educational services, clearly to understand the commitments of the institution concerned. Taylor (2001:6) also argued in support of this position, stating that "...research management plans need to be founded on the major institutional mission statement...set for research".

Apart from being encapsulated within a research mission statement, the role of research was also to be embodied in the institutional mission statement and strategic objectives of the institution concerned (Fransman, 2000). In this way, the institutional mission statement would be instrumental in achieving the integrated approach and culture that was conceived as being critical to the success of the institutional research profile.

Ogude (2000) observed that technikons had, since the promulgation of the Technikons Act No. 125 of 1993, invested much time and effort, as well as multiple resources, in the development of a research culture and in motivating staff to conduct research. However, the main challenge facing technikons in South Africa "...is how to convince staff members whose main focus for several years has been teaching to engage in research" (Ogude, 2000:2).

Ramchander (2000:16) suggested that the reason why it may have been difficult to convince technikon staff to do research was that the "...importance of research for the advancement of practice-oriented

technological knowledge, skills, proficiency and scholarship is not recognized as an important function of the technikon".

According to Uken (1995:149), in order to transform the teaching culture, research "...has to become fashionable...". He was of the opinion that the research culture at technikons would be developed only when staff and students "...are seen to be having a lot of fun in doing research...". The successful establishment of a research profile would also only be achieved if senior staff could provide efficient leadership (Fransman & Rowley, 1999). Convincing staff to undertake research would depend on the organisational cultures and structures making provision for the rewarding and/or promotion of staff based on their outstanding teaching performance, as well as research (Fransman & Rowley, 1999).

The CHE (2003:81) highlighted the value of postgraduate supervision and research training in the transformation of the teaching culture. "Postgraduate supervision and research training is a core academic activity for most higher education institutions worldwide and is distinctive in that it provides the link between research and teaching and learning". Therefore, the supervision process "...is essentially a...teaching and mentoring activity..." (Council on Higher Education, 2003:80).

Research supervision as a teaching and learning activity possesses a momentum and nature different to that of undergraduate teaching. Such a distinction must be recognised at an institutional level if the institutions concerned aim to establish a culture of teaching, learning and research; to integrate teaching and research; and to break down the resistance that staff have to doing research and being involved in research supervision.

Management, especially at faculty level, should create an enabling environment for staff to be able to pay the required attention to postgraduate students. Such an environment could be achieved by allotting the appropriate amount of time necessary for both postgraduate students and undergraduate students, so that the educational development of neither is comprised. In other words, to balance research effectively with teaching and learning, and to integrate research with teaching and learning

activities, an appropriate mechanism should be put in place in order to ensure the successful throughput of postgraduate students. If such an advance did not take place, UoTs would be unsuccessful in their endeavour to provide the South African labour market with the desired highly-skilled technological human resources. Winberg (2005) also addressed the problems attached to factoring research supervision into workloads of technikon staff.

The above discussion referred to a number of authors who emphasised the value of research for teaching, as well as what could be done to transform the teaching culture. In spite of this, research remained, in the words of Gihwala (1995), an “inhibited activity”. He blamed the overemphasis on teaching as being a serious inhibitor of research at technikons. In spite of Gihwala’s finding, Van Rensburg (1995:15–16) remained adamant about the value of the teaching function of technikon staff, asserting that “[t]echnikons should re-emphasize teaching in all its forms, both inside and outside the classroom”. Giving due acknowledgement to the “research and teaching dilemma”, Van Rensburg (1995:15–16) suggested a way in which technikons could cope with this scenario: “Some technikons may find that they will be able to do justice to teaching while still maintaining and developing their research activities, while others may find they need to focus only on teaching”. Taylor (2001:4, 6), a Professor of Accounting from Curtin University of Technology, reported on anecdotal evidence when he visited the Technikon SA and asked the question: Why is the active pursuit of research important to an institution of higher education?

The answers to Taylor’s question suggested that research added very little value to teaching; that time and other resources for research, which were viewed as a luxury, were limited; and that technikon staff were unwilling to move into a territory traditionally occupied by universities. Technikon staff of the day saw scholarship as being the responsibility of universities and as essentially inconsistent with the teaching emphasis of technikons. Staff members were generally of the opinion that “...excellent teaching is of paramount importance [in a ‘teaching institution’] in equipping graduates for employability in the real world...” (Taylor, 2001:6).

The holding of such views certainly accounts for the relatively low degree of participation by technikon staff in research, which, in turn, symptomised the challenges faced by technikons in convincing their staff to undertake research. It also makes provision for the common belief among especially the technikon officials that research strengthens teaching (CTP, 1998; Du Plessis, 1996; Du Toit & Van der Wal, 1994; Fransman, 2000; Gihwala, 1995; Koen, 1996; Mabuza, 1999; Pretorius, 2001; Ramchander, 2000; Van Rensburg, 1995).

The above discussion demonstrates that transforming the teaching culture at technikons was a challenging process in many respects. Although the literature consulted suggested that research held value for the improvement of teaching, staff still had to be convinced of this fact and the question was to what extent the sector was succeeding in this endeavour. If the efforts exerted in this regard failed to contribute to the firm establishment of a research culture, other measures would have to be put in place.

#### 4.4.2 Staff research capacity

As mentioned previously, the 1998 Research Philosophy explained that the teaching culture should be transformed to include a culture of research.

The CTP suggested that this aim would be achieved by advancing staff through vertical higher qualifications. Uken (1995:147) identified that the research culture depended on the research capacity, declaring that the lack of research capacity related to the absence of a research culture at technikons. The building of the research capacity of technikon staff therefore became an issue that needed attention.

The issue of insufficient technikon staff research capacity is now explored, with reference to a number of ways in which capacity could be built up.

Firstly, the endeavour to improve technikon staff qualifications, though consisting of a well-meant initiative aimed at staff development, nevertheless encompassed a very narrow understanding of research capacity building. Though accelerating staff through higher degrees had many advantages, it did not guarantee staff research capacity.

Firstly, this was especially applicable to, and true of, staff embarking on research-based studies for the first time at the PhD or D Tech level. The impact of this phenomenon on student research development was of concern. Such staff members would not have been in a position to supervise technikon students at the M Tech level, due to their having, themselves, 'skipped' that level of development.

Secondly, staff research capacity referred to more than just the capacity to do research. Such capacity also included the capacity to supervise research, to manage research projects, to access research funding and to facilitate learning at the level of the two highest technikon qualifications. Advancing staff through the higher degrees would neither necessarily nor automatically build capacity in these equally essential areas.

At the time when technikons introduced the degree qualification structure, Gihwala (1995:69) questioned the capacity of technikon staff to meet the research challenges posed by this new development. "Technikons evolved from the Colleges for Advanced Technical Education and one questions whether staff who were adequately qualified to teach at a technical college level were adequately prepared to meet...especially the research requirements". Regarding staff qualifications, Gihwala added, "...research remains an underdeveloped area of Technikon activity and staff qualifications continue to give concern". The link between sufficient research capacity and staff qualifications was therefore also made by Gihwala.

Thirdly, Pietersen (1995:89–90) listed a number of factors impacting on individual research capacity. In reference to Beukes (1984), Helm and Hay (1993) and Smit (1989), he highlighted the absence of research experience, research competence and supervisory abilities among staff at that time. He also cited Marais (1986), emphasising the predominance of the "...so-called teacher-types [and] the...presence of compilers and not researchers...". Furthermore, he noted a strong presence of the "...predominance of convergent cognitive styles..." among staff, which indicated a preference for order and structure. Such an approach,

according to Pietersen, was especially problematic for the initiation of research. Chetty (2003:11), also in reference to this phenomenon, suggested that "...lecturers need to re-tool themselves as academics and transcend the role of teachers" (Chetty, 2003:11).

The observations made by Pietersen and Chetty truly seemed to reflect reality. As a result of the original emphasis and focus of technikon education, staff found it difficult to shed their 'teaching jackets' and to transform and re-tool to meet the demands of being both researchers and trainers of research students. The specialisation of technikons in the education of 'doers' in contrast to the focus laid by universities on educating 'thinkers' was instrumental in making technikon staff 'doers' rather than 'thinkers' in their approach, which inevitably problematised the undertaking of research and the training of researchers.

Fourthly, it has been argued that technikon staff lacked research capacity. I also argued that this does not refer only to the capacity to do research. Because of this historic development of technikons, there were other aspects of research capacity that technikons had to address.

Malan (1999:1, in reference to Dowling (1997:8)) described a number of facets of the research capacity of technikons, namely a "...lack of qualified staff to engage in research and to mentor students; a lack of relevant background in research methodology; not knowing how to write proposals and access funds; a lack of physical resources and research budgets".

According to Haag (1995:123), a number of shortcomings existed in the area of technikon research expertise, including that lecturers "...are primarily drawn from industry where research takes the form of investigations to solve day-to-day operational problems...". Instead of seeing the sourcing of lecturers in industry as a shortcoming, problem-solving research at technikons should be optimised by accessing the skills of such staff when training technikon research students.

The question still remained as to how to build the research capacity of technikon staff.



Cooper (1993:41) supported the idea of the CTP that staff research capacity would be enhanced by improving their qualifications. He, however, raised this point in terms of enhancing the education and training function of the technikons, saying "if technikon education is to improve, there is an urgent need to upgrade the qualifications of staff at technikons, many of whom do not have certification above the HDip level".

Technikons needed to implement a more comprehensive research development programme. The current researcher believes that many technikons abdicated their responsibility of research capacity building by leaving it up to their staff to enroll for higher qualifications and in hoping that their capacity to do research would be enhanced by so doing. In addition, the technikons also failed to establish sufficient financial backing to enable their staff to do the required research. This role the technikons left for the former CSD, FRD, and later the NRF, to play.

The statistics enumerated in Chapter Five indicate the outcome of this position for the technikons. The NRF later emphasised the need for an institutional contribution or for 'matching funds', as such funding became known.

Stewart (1995:112) also referred to some of the fundamentally incorrect assumptions about research capacity building, namely "...that methodology training and incentives for staff to undertake research and improve their qualifications will influence the nature of their teaching...and the acquisition of research skills". He acknowledged that research training could motivate staff to do their own research, but "...true capacity building can take place only when staff themselves are involved in their own projects and can directly or indirectly involve their students in their activities" (Stewart, 1995:112).

According to Ogude and Motha (2001:60), technikons would only build capacity if the research management at technikons "...employ imaginative, bold and aggressive capacity building incentive programmes which can recognise and improve the research skills of academic staff".

Chapter Three referred to the role of the NRF in the restructuring of higher education and in the development of technikons, therefore only brief reference will now be made to a few points regarding the NRF's position in terms of research capacity building at technikons, as outlined in the Technikon Research Development Programme Framework for 2002 to 2007. "The various programmes and initiatives within the Research Capacity Development... initiatives of the NRF are aimed at the development and support of people, infrastructure, facilities and systems" (NRF, 2002:1). NRF investment would be concentrated in three areas, namely in the areas of human resource development, the building up of a research environment and the development of research areas focusing on programmes addressing weak disciplines and national strategic research areas, as well as "...gaps in the national research system" (NRF, 2002:1–2).

The NRF in 1995 (4) referred to the National Plan for Higher Education that "...recognises the critical role that technikons must play in meeting the country's human resource needs – up to doctoral level". It further referred to the fact that sustainable research capacity could not be established over a period of only five years, referring to the "window period" of five years that had been given to technikons for upliftment of their level of research productivity and output. The NRF (2002:7) therefore adopted an institutional approach to research capacity building consisting of two major, environmental and human, components. The NRF held that "[r]esearch capacity is anchored within an organisational setting". By this, it meant that research productivity, quality and relevance would lean heavily on the institution's ability to support research. The technikons had to be capable of providing researchers with a sound research environment, adequate training and the necessary physical infrastructure; the ability to acquire and manage necessary research funds; the ability to develop management systems and policies that were geared to the support of research; and the ability to develop an overall culture supportive of research and inquiry.

#### 4.4.3 Concluding remarks

This section discussed the two factors impacting on the successful introduction of research for staff development, namely the desire of the CTP to transform the academic culture at technikons to include a teaching and research culture and the building of staff research capacity. Regarding these two factors, the discussion shows that not only was the research culture challenged by the lack of staff research capacity, but the transformation of the teaching culture was itself challenged by the lack of staff research capacity.

The transformation process was particularly demanding for staff employed at technikons, who, themselves, were products of technikon education. Due to their having been trained in the 'teaching paradigm', it was difficult for them to make the required paradigm shift. Similarly, the demands made of university-trained technikon staff that they become involved in applied research and supervise students doing applied research were also exacting, because the majority had received their training at universities in a more 'basic research paradigm'.

The recommendation made by Van Rensburg that some technikons could focus on teaching and some on research is not seen as an acceptable route out of the teaching versus research dilemma. The implementation of such a suggestion would have led to the development of a dysfunctional research capacity in the technikon sector. More sensible would have been the advocating of a position acceptable to all technikons of granting assistance to those technikons lagging behind in terms of research capacity.

The discussion highlighted the importance of making a paradigm shift in capacity building in order to contribute to a well-developed profile of research at technikons. The importance of staff capacity was also addressed in the National Plan for Higher Education in 2001, with technikons being given a window period of five years in which to address capacity in order to ensure their place in the new higher education landscape.

Not only was sufficient staff capacity required to conduct research, but the building up of the capacity of staff to enable them to supervise research at master's and doctoral level in the respective industrial fields was also necessary.

Therefore, the assumption that research methodology training and incentives would lead to enhanced staff research capacity established itself so well that it formed part of the research value system at technikons at the time that this thesis was written. Such a conception is, however, fundamentally flawed, as neither methodology training nor incentives *per se* build research capacity. Only when these endeavours lead to staff involvement in research projects can true capacity building be achieved.

Although the urgency of the need to build research capacity at technikons was acknowledged, few feasible and practical measures aimed at addressing capacity building were evolved. Such limitations impacted negatively on the establishment of a research culture at technikons. Instead, there was a tendency to accept that research capacity building and the establishment of a research culture at technikons was primarily a research management issue.

#### 4.5 THE TYPE, FOCUS AND ORIENTATION OF RESEARCH AT TECHNIKONS

In the light of the general perception that technikon staff mostly conduct applied research, attention now turns to the type, focus and orientation of research undertaken at technikons. In addition, the expected role and function of technikon staff as trainers of technologists is given attention.

The Department of National Education, by 1979, had already accepted that technikons should be responsible for conducting applied, developmental and technikon-didactic research. Such a responsibility was mostly the result of the introduction of advanced technical courses at the technikons of the day (Phillips, 1980; Pittendrigh, 1988).

In the 1989 Research Philosophy for technikon education, the CTP highlighted a number of reasons for introducing research at technikons, including that research would be undertaken at technikons as a means of improving South African industrial productivity and economic competitiveness, as well as of addressing the noticeable lack of product innovation. The CTP clearly demonstrated a commitment to applied research for the purpose of economic growth and social development, as well as the overall reconstruction of South Africa. As a result, it was suggested that research at technikons should be conducted in partnerships with such bodies as government departments, research councils, and commercial and industrial enterprises.

At the same time, a parallel was also drawn between the concepts of 'applied research' and 'advanced technical education'. The M Dip Tech qualification aimed to foster student involvement in extending the application of technology, while the Laureatus qualification aimed to encourage student development of new technology.

In its vision for establishing a research culture at technikons, published in 1998, the CTP further expressed a fervent desire for technikons to become involved in applied research. Apart from expressing this wish in its vision, the Committee explicitly voiced the commitment of technikons to the pursuit of applied research. In terms of this commitment, the CTP stated that technikons, in conducting applied research, would be able to contribute significantly to the social development and reconstruction of South Africa. This the technikons would achieve through their potential as regards applied research in respect to addressing the issues relevant to the developing social and industrial South African situation.

The CTP meant that the conducting of applied research was the most suitable method for training technology researchers and that South African industrial performance would be enhanced with the increased employment of technikon-trained technologists.

One of the objectives of the cultural transformation of technikons was that technikons should make a specific contribution to the development of small, medium and micro enterprises by addressing their research and development needs. The CTP stated that technikons should, through their participation in research, address the shortage of technology researchers, as well as right the existing imbalance between basic and applied research.

The eventual confirmation of, and commitment to, applied research as the focus and orientation for technikon research also developed as a result of the parallels drawn between applied research and a number of further well-known thrusts of technikon education. Such parallels involved industry innovation and problem solving, the technological nature of technikon education and technikon research, and technology transfer. Each of these aspects of the association of technikons with applied research receives attention in the discussion that follows.

#### 4.5.1 Industry innovation and problem solving

The first factor contributing to the confirmation and commitment of technikons to applied research was the strong orientation of technikons towards industrial innovation, product development and industrial problem-solving. Research conducted at technikons should not only "...provide practical solutions to problems for industry or the community...to bring about a climate for innovative ideas", but also generally be goal-oriented (Petersen & Coetzee, 1995:338; Von Gruenewaldt, 1995:117).

Research was initially accepted at technikons as a way of enhancing the system's capacity to supply industry with the required level of human resources in the field of technology. The human resources involved should not only be able to identify problems, but also to solve them. In this way, the technikons came increasingly to be associated with applied research, with innovations taking place as a result of applying new improved and developed methods and processes in production.

The CTP explained both the initial and more broadened orientation of research to applied research as follows: "In the technikon's research

component, and more especially in technology development, the emphasis is to a large extent placed on problem solving and innovation (CTP, 1994:3). Technikons, as degree-awarding institutions, should, however, not only contribute to industrial innovation for the purpose of economic growth, but also to the social development and reconstruction of South Africa as a whole (CTP, 1998).

Uken (2001:241) explained why technikons were mainly oriented towards applied research: "... the Cape Technikon subscribes to the view that real-life problems should first and foremost be identified, be they in commerce, industry or the community we serve. Only then is the need for R & D considered...."

#### 4.5.2 The technological nature of technikon education

The second factor contributing to the confirmation and commitment of technikons to applied research was their strong orientation towards technology and technological education. According to Beukes (1984:5), the applied focus of research at technikons was linked to the applied nature of the education provided by the institutions at the time. Van Rensburg and Greyling (1985:1) also emphasised this orientation: "Technikon technical training is specific because it is directed towards career training. This type of training necessarily influences the type of research in which technikons are engaged."

The technological nature of technikon education includes a number of facets, but refers mostly to the fact that technikons educated learners to be employable in commerce and industry by training them in the practice of technology, as well as in how to undertake technological research. In this regard, it is important to note the difference between technological development and technology development.

According to Bester (1988:20), "Technological development refers to the general development of the national technological ability. Technology development refers to the development of specific new products and procedures."

According to Jacobs (1996:4), the report of the Goode Commission had far-reaching implications for the future planning of the scope of research to be undertaken at technikons, of which the most prominent was the fact that the Goode Commission provided a clear parallel between the technological nature of technikon education and the research conducted as part of the training of the technician, technologist and engineer.

Gihwala (1995) agreed with this concept when highlighting three characteristics of technikon research. Firstly, technikon research should be organised in such a way that it served both the short-term and medium-term human resource needs of industry, commerce and the public sector. Secondly, technikons should focus on training technicians and technologists. Thirdly, technikons should also "...provide industry with a high quality service not only in terms of qualified personnel but also in terms of professional service" (Gihwala, 1995:68).

Due to the historically fundamental relationship between technikon education and industry, technological development and the solving of industry-related problems became a natural focus and orientation of technikon research. According to the DNE, research at technikons was instrumental in achieving two objectives: the creation of new knowledge as well as the keeping of researchers at the forefront of new developments in industry and commerce (Department of National Education, 1988).

#### 4.5.3 Technikon research and technology transfer

The third factor providing evidence of the commitment of technikons to applied research was the potential role of technikons in the transfer of technology. The role and function of technikon research in technology transfer underwent transformation during the 1980s and 1990s. The present discussion mainly describes this transformation. Essentially, the view during the 1980s was that technikon research provided a useful mechanism for technology transfer.



During the 1990s, the process of conceptualising technology transfer continued, eventually leading to the development of the idea that technikon research should focus on technology transfer.

Initially, the technikon officials equated the process of technology transfer with that of the dissemination of technological knowledge. The CTP recognised that technology transfer could be accomplished in a variety of ways, but that "...the technikons [in particular], must surely be in the forefront in the effective dissemination of knowledge" (Steyl, 1986:6, 7). The CTP highlighted the importance of the leadership role that technikons should play in the field of technology and technology transfer (Steyl, 1986).

In relation to this point, Wiid (1988) observed that a technologist educated by a technikon is responsible for the process of technology transfer. He described technology transfer as involving the transfer of technology from source A to source B and the acceptance, utilisation and maintenance of the newly acquired technology by source B. Wiid identified three elements that were necessary for technology transfer to take place, namely the acceptance, utilisation and maintenance of technology. In turn, Bester (1988:15, 69, 111) argued that technology transfer was based on links between people, urging that technikons and industries should "...foster interaction between people from the two sectors in order to stimulate technology transfer...This may lead to formal co-operation agreements."

The above discussion shows that the technikon sector underwent a process of redefining the practice and promotion of technology, technology development and technology transfer during the 1980s, with its starting to conceptualise the role of research undertaken at technikons in the process of technology transfer during the 1990s.

Gihwala (1995:67) expressed the view that technikons, in carrying out their task, "...concentrate on...promoting the transfer of technology by continuously assessing the relevancy of course material presented to students in relation to the needs of its industrial, commercial and service clienteleles...".

He further argued that technikons should be in touch with industry to ensure that they could update their courses accordingly and, by so doing, promote the transfer of technology.

According to Van Rensburg (1995:22), technikons had a major role to play in enhancing the "...status, role and capability of organisations engaged in technology development and transfer...". Van Rensburg argued for the existence of a strong link between the technikon sector and technology transfer, as technology transfer facilitated technological innovation by means of facilitating a flow of ideas between industry and appropriately qualified technikon staff. He emphasised that the active development of technology relies on the effective and continuous flow of people between industry and the technikons. Van Rensburg (1995:22) found such transferal of applied knowledge necessary, due to the "exploitation" of technology being "...most effective when it takes place along a flow of appropriately qualified staff who 'carry' the unwritten exploitation of technology...". Van Rensburg (1995) also equated the work done by technikon staff in industry in the form of the offering of short courses to the work involved in the transfer of technology.

According to Van Wyk (1999:1), technikon "...research and development should focus on the development and transfer of technology as well as the successful implementation thereof". This process presupposed that technology was tantamount to the application and utilisation of scientific knowledge in commerce, industry and the public sector. The practice of technology, according to Van Wyk (1999:1), originated from a "...given practical problem..." that supplies an opportunity to find new applications for existing scientific knowledge". This explanation of the practice of technology and the rationale for the transfer of technology effectively demonstrates the nature of the applied research envisaged as being undertaken by both technikon staff and students.

The CTP published details of its most recently held, as prior to the publication of this thesis, position on technology transfer and the technikons' role in April 2003.

In its statement, the Committee (2003:4) described technology transfer as consisting of the "...formal transfer of new discoveries, innovations and technology, resulting from research and development activities at Higher Education Institutions, to the commercial and industrial sectors...". The CTP definition portrays both the correlation of, and relationship between, technology transfer and the commercialisation of technikon research. The definition describes the process of technology transfer as consisting of a sender, a mediator, the technology involved, the receiver, the aftermath of the transfer and the assessment, identifying five distinct components: acquisition; development; application; diffusion; and management (Committee of Technikon Principals, 2003).

#### 4.5.4 Concluding remarks

This section explored a number of different aspects of the type, focus and orientation of research at technikons, as well as of the connection between technikon research and technology transfer. The focus is in line with the fact that the technikons adopted an applied research orientation mainly because of their vocational orientation and their aim to provide the labour market with technologists. The developments that took place, stimulated by the renewed emphasis on technology education by the technikons concerned, are significant, contributing, as they did, to a shift away from a focus on, and orientation towards, applied research towards a new focus on, and orientation towards, technology transfer.

#### 4.6 THE PROVISION OF TECHNOLOGISTS

The CTP identified an opportunity for the technikon sector to address the shortage of high-level technologically skilled human resources. Such an opportunity presented itself because of the inability of South Africa to compete industrially during the 1980s, due to the sanctions and boycotts imposed on the country as a result of the government's apartheid policy, as well as due to the shortage of problem-solvers and innovative product developers necessary to enhance South African industrial performance.

These issues were fully explored in the philosophy for technikon education, published by the CTP in 1989.

The CTP used the shortcomings of this situation to advance the cause of technikon education by means of advocating the addition of two levels to the existing qualification structure. Such a development meant that qualification-based research for students had to be introduced and developed, as doing so was the only way of training technological problem-solvers and of stimulating technological innovation. The CTP believed that these qualifications would have as their output technologists who would be sufficiently well equipped to undertake applied research and to transfer technology effectively. In effect, the CTP used these initiatives to expand the applied nature of technikon education. The Committee also aimed to address the imbalance that existed between the provision of basic and applied researchers.

However, a number of factors played a significant role in the development of qualification-based student research at technikons. Firstly, technikon student research was initially not accepted by the DNE. Secondly, confidence in the technikon advanced diploma had to be created and, thirdly, the technological higher degree was a concept that took time to become established. A brief discussion of these issues follows.

#### 4.6.1 Acceptance of technikon student research

In spite of the efforts of the CTP to advance technical education by adding research to the education and training function of the CATES, the Department, in 1977, accepted that, though research could be undertaken by the staff, it did not accept "...research by students leading to higher qualifications" (Pittendrigh, 1988:187).

Technical colleges in South Africa advanced in status when redesignated CATES, in 1967. Further progress on the status of the colleges was made with the implementation of the recommendations of the Van Wyk de Vries report, in 1974, and the Goode report, in 1978. These reports led to the redesignation of the CATES as technikons in 1979.

The Goode Commission recommended the "...extension of courses beyond the basic diploma...based on a thesis, project or design, with its report mostly dealing with "...the need for research as part of advanced technological study" (Goode, 1978:125; NATED 02-118 (88/07):8; Pittendrigh, 1988:194).

As a result of the meetings that took place between the Association of Technikons and the DNE, "...the concept of limited research by a technikon student leading to a dissertation as part requirement for a higher qualification (at that stage the Diploma in Technology) and in-depth research leading to a thesis as full requirement for a laureatus qualification", was accepted by the Department, in 1979 (Pittendrigh, 1988). The acceptance of such a concept was a positive step and "...the implications of this meeting were that the ...technikons had a research function to perform" (Pittendrigh, 1988:194, 240, 241).

This acceptance of research as forming part of the system of advanced technical qualifications and the redesignation of CATES as technikons formed important milestones for the sector. The Association of Technikons referred to the event in its 1979 Annual Report as follows: "As...more advanced courses being introduced at Technikons include research projects, the Department has recognised that research...will have to be conducted at Technikons" (Phillips, 1980:5).

#### 4.6.2 The creation of confidence in the technikon advanced diploma

The next challenge for the sector was to instil confidence in the public in the value and quality of advanced qualifications, which were eventually added to the available range of technikon qualifications in the 1980s. During the years that the status as well as the names of the qualifications were undergoing a process of redefinition, enrollments, in comparison to graduations from the national diplomas, did not gain the expected momentum. The relatively low rate of enrollment naturally led to the slow development of student research at the technikons.

One of the factors that impacted on student enrollments for the two advanced qualifications was the debate regarding the names of the qualifications. This debate included a number of elements. Fears arose that the non-differentiation of the name of the diploma issued on completion of three years of study, namely the Diploma in Engineering, and that of the qualification issued on completion of five years of study, namely the Diploma in Technology (Engineering), would cause confusion (Pittendrigh, 1988:240). As a result of the envisaged confusion, the designation 'Master in Technology' was considered at the time (Pittendrigh, 1988; Steyl, 1986).

In order to clarify the situation still further, the Association proposed that the technikon qualification range be rationalised. For this purpose, it compiled a hierarchy of awards ranging from M+1, representing Std. 10 plus one year of further study, to M+6, representing Std. 10 plus six years of further study. The Association had already by that stage received departmental approval to introduce the hierarchy of qualifications and was in the process of determining designations and titles for these awards, especially for the awards from the M+4 level upwards (Phillips, 1980).

The Association hoped that the two highest advanced qualifications would "...draw students to the awards in the same way as the university degree..." (Phillips, 1980:1–2). In line with this expectation, the Association proposed to drop the word 'diploma' at fourth-year level and suggested the use of a more appropriate title, indicating that diplomates would "...graduate from [the position] of Technicians to those of Technologists" (Phillips, 1980:1–2). The Association confirmed that research would play a part at all levels of qualifications above M+3" (Phillips, 1980:1–2). Such reshuffling of the educational system effectively meant that research would be introduced at the NHD level, which was a level originally designed for the training of technicians.

In 1981, the Association (Wolffe, 1981:2, 6) wrote, "...the task of the restructuring of existing National courses to meet the criteria of the newly laid down Hierarchy of Awards has almost been completed [and] the most important...is the proposal that the title for the M+5 qualification should be

unique to Technikons. It is proposed that the title be designated as 'Laurea Technologiae'...at this stage...unanimity has already been reached in regard to the titles of National qualifications up to the M+4 level."

During the period 1982 to 1987, important changes took place with regard to the appellation of the M+5 qualification. In 1982, the Association of Technikons reported that the designation of Laurea Technologiae was not accepted for the M+5 qualification (Knoll, 1982).

In the 1984 Annual Report, the CTP (Van Rensburg, 1985:3) wrote: "A unanimous proposal by all technikons for the allocation of new titles at the fifth and sixth-year levels, is in the final stage of preparation and will be submitted to the DNE for consideration and approval."

The year 1986 was momentous for the development of technikon education. In this year, the CTP was informed that the change in the title of the technikons' two most advanced qualifications was approved by the Department. The CTP was of the opinion that the "...change of title to Master's Diploma in Technology and Laureatus in Technology will undoubtedly greatly assist the technikons in their attempts to stimulate study at these levels ..." (Shippey, 1987:2).

#### 4.6.3 The technological higher degree and research at technikons

According to the CTP, the degree structure did not effectively introduce research at technikons. Research was part of technikon education from the time when the CATES were redesignated technikons in 1979, while the advanced qualifications were only added to the course structure in 1981. The Committee (CTP, 1994:13) remarked, "It must be stated categorically that technikons have already established a research culture and have in fact been offering advanced programmes on the Master's Diploma and Laureates levels for some years. For both these qualifications, independent research is required." Exactly what the CTP meant by a "research culture" is unclear, though it is noteworthy that it linked the presence of a research culture to that of advanced qualifications.

Technikons still, in spite of the tremendous improvement made to the status and designation of the two advanced qualifications, could not succeed in gaining the confidence of the public in the two advanced qualifications. The higher qualifications' enrollment figures, as provided in Chapter Five, indicate that the public continued to attach more value to advanced degrees. Once again, the technikon sector found itself having to choose a course of action to ensure the maintenance of a competitive position in terms of the advanced qualifications offered. In an attempt to increase the interest of students in advanced technikon qualifications, the CTP once again became embroiled in the redesignation of the qualifications concerned and the "debate on the introduction of degrees in technikons received momentum during the year..." (Du Preez, 1992:6, 7).

In 1993, the Technikons Act, on approval by Parliament, was promulgated in the Government Gazette of July 1993 as Act No. 125 of 1993. However, although the amendments to the Act were proposed and approved by the CTP and submitted to the DNE in September 1993, the amendments could not be submitted to Parliament at the time due to an over-heavy legislative programme in Parliament. During 1993, the CTP also accepted the Framework for the introduction of degrees at technikons (Sonn, 1994).

The NATED 02-150 policy document, which enabled the submission of new degree programmes, was finally approved in February 1994 (Sonn, 1994). In the 1994 Annual Report, the CTP wrote, "In accordance with the CTP policy document *A framework for the introduction of degrees at technikons*, the CTM has considered and approved a number of programmes for degree worthiness" (Snyman, 1995:4). The Minister of Education accordingly approved the introduction of a number of degree courses, including a few master's and doctorate degrees, to be offered by the technikons as from January 1995 (Snyman, 1995).

The CTP, having to conceptualise the nature of the two advanced degree-based qualifications, described the Technikon Master's Degree as aiming at the "...execution of a developmental research project which will improve or extend the application of technology" (CTP, 1994:10), while the Technikon



Doctorate aimed at the "...development and application of a new technology" (CTP, 1994:10). Research would form a very definite component of the technikon degree in future: "Technikon degree programmes should afford access to further study, be aimed at acquiring high-level analytical skills and promote self-development through independent research" (CTP, 1994:12).

The CTP conception of the technikon degree clearly assumed a role and function for research at technikons. Furthermore, according to Du Toit and Van der Wal (1994:3), "[s]tudents are not only taught to acquire technological knowledge, but also to apply it in practice, especially when confronted with a problem situation. This implies that research skills should form part of the training of every technologist."

Another very important reason existed for restructuring the qualifications concerned. Technikons believed that the introduction of degrees would bring an end to the questions raised about their tertiary status. Several years before the introduction of degrees, Van Rensburg and Greyling (1985:1) had emphasised the presence of research as a prerequisite for an institution to be regarded as a tertiary institution: "Research training and teaching form the apex of the pyramid in tertiary education. Technikons in South Africa need to accept and develop this function to its fullest extent...."

Reference was further made to the obligation of technikons: "The new parallel development of the university and the technikon places the obligation on the technikon to ensure that tertiary standards are maintained at all levels of career orientated education, including research efforts" (Van Rensburg & Greyling, 1985:1). The research function, consequently, became instrumental in positioning the technikons as tertiary institutions and as fully-fledged providers of higher education, as well as the realisation that this important role and function of research at technikons was not new.

As a result, the CTP (1991:2) requested that attention be given to the following:

- the formulation and promulgation of a clearly defined state policy in respect of manpower and technology;
- the promulgation of a single act for technikon education;
- the re-evaluation of the roles of the various educational institutions;
- the proper positioning of these institutions, relative to one another;
- a re-alignment of State fund allocations for education;
- a re-evaluation of the status symbols, such as the qualifications concerned; and
- the redefinition of the term 'tertiary', as it would apply to technology and vocational/career education.

The above request of the CTP demonstrates that the CTP at the time called for clear government directives and closer collaboration between the government and the CTP regarding the provision of higher education for South Africa. The Committee (Committee of Technikon Principals, 1991:2, 3) was of the opinion that a redefinition of the term 'tertiary' would lead to the following:

- the correct establishment of the position of technikons in relation to the other educational institutions;
- the enhancement of the level and status of technikon education and programmes offered;
- the correct positioning of research within the technikon sector; and
- the facilitation of the introduction of degree programmes.

#### 4.6.4 Concluding remarks

The technikon sector found itself in a dilemma in terms of its ability to provide high-level skilled technological human resources for employment within South African industry. Such was the result of the absence of a clear vision being provided by the CTP for the development of student research as a crucial element of establishing a research culture, a research culture essential to the sustainability of research at technikons.

The CTP addressed the shortage of the necessary high-level skilled technological human resources by initially introducing higher diplomas at

technikons in the 1980s, as well as higher degrees in the 1990s. Such developments naturally included student research, but, other than that, the technikon sector made insufficient provision for the development of student research in its research and development philosophies and guidelines.

The problem with the CTP vision for establishing a research culture at technikons was that the introduction of research strongly hinged on the provision of research opportunities for staff development. The measures necessary for the implementation of research, so that it would produce the required technologically-skilled human resources, did not form part of the CTP's vision for establishing a research culture at technikons. The absence of such measures compromised the development of student research.

The struggle to finalise the names of the two highest qualifications led to uncertainty for prospective students wishing to further their studies at the technikon. The difference between graduating as a technician rather than as a technologist, at the time, did not mean much to members of the general public who were responsible for deciding where they would send their children on completion of a national technikon diploma. Lack of clarity existed in regard to the value of a technikon higher qualification and the contribution that it might make to employment prospects of diplomates.

Amongst others, this issue certainly stimulated the efforts of the CTP to push for the introduction of degrees. This step naturally brought with it an emphasis on research as a component of advanced technical education. In spite of this, members of the general public, until today, do not yet fully understand the value of technological postgraduate degrees.

The lack of reference to student research in the literature was another issue of concern. In general, authors referred to technikon research or to research conducted at technikons. The CTP database of registered master's and doctoral projects for the period 1984 to 1999 still does not differentiate between projects registered by technikon staff and those registered by technikon students.

In addition, reference to student research was usually made within the paradigm of the completion of higher qualifications. Scant evidence exists of the participation of students in non-degree projects, possibly because the research involvement of students in such projects was significantly low.

The lack of attention paid to student research points to a problem, firstly, for student research development; secondly, for postgraduate enrolments; thirdly, for technologist education and training; and fourthly, for the supply of high-level skilled human resources with the ability to identify and solve problems, transfer technology and contribute to South African technological innovation.

#### 4.7 CONCLUSION

The essential strategies and plans for establishing a research culture at technikons, as well as the relationship between the two, are indicated in Figure 1. The strategies and plans illustrated in this framework form the basis of the input and process factors identified as a basis for the discussion of the statistical profile of research for the period 1998 to 2002, as discussed in the next chapter. The framework also indicates the output factors that refer to the extent to which the sector was successful in achieving its objective of establishing a research culture.

The framework represents my construct of the strategies and plans that the technikon sector had for establishing a research culture at technikons. These strategies and plans refer to the advancement of the education and training function of technikon, meaning the ability of technikons to provide South Africa with skilled technologists by way of advanced qualifications, as indicated in blocks 1, 2 and 6. At the same time, the introduction of advanced technical qualifications was an attempt to promote the practice of technology and technological innovation, as well as to restore the imbalance existing between the supply of basic and applied researchers, as indicated in blocks 3, 4, 5 and 6.

The CTP used the introduction of advanced qualifications, initially diploma-based and later degree-based, as the main strategy for establishing a research culture at technikons.

In order for research at technikons to acquire a unique character, the technikons adopted an applied research orientation, largely because of the historical link existing between the technikons and industry, as indicated in blocks 7, 8 and 9. This orientation facilitated technology transfer, which later became instrumental in the social and reconstruction process in which the CTP felt technikons could actively participate, as indicated in blocks 9 and 13. In order to achieve this aim, the CTP suggested a managerialistic approach to the building of research capacity and the establishment of a research culture, as indicated in blocks 10 to 13. The CTP suggested that this could be done by means of establishing research focus areas concentrating on the research strengths of the technikons.

Although the above strategies and plans have been put in place to establish a research culture, it seems apparent that these endeavours of the CTP seem to have rather been implemented to ensure a competitive position for technikons in the new higher education university-based landscape.

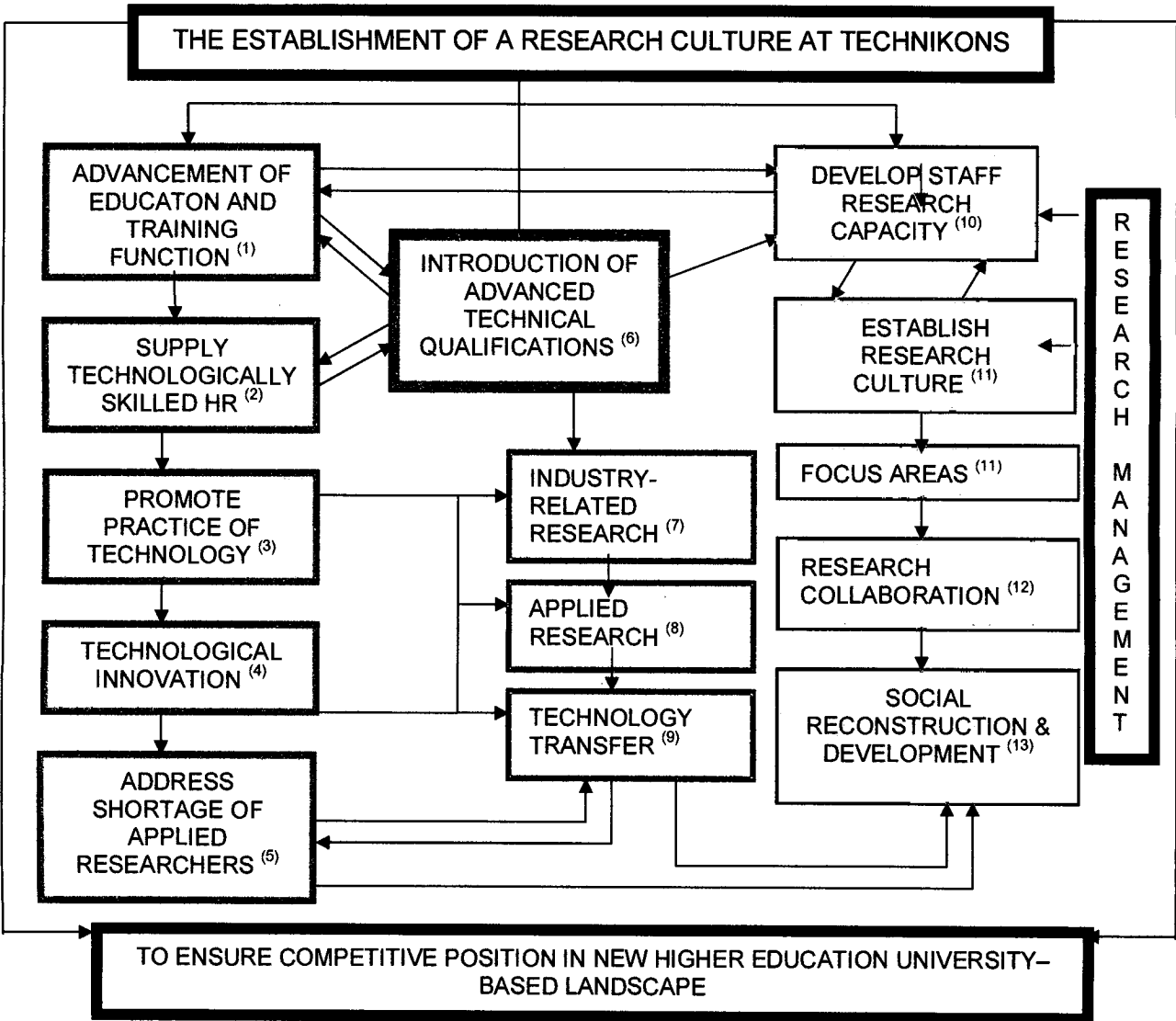


FIGURE 1: THE ESTABLISHMENT OF A RESEARCH CULTURE AT TECHNIKONS

## **CHAPTER FIVE**

### **A PROFILE OF THE RESEARCH CULTURE AT TECHNIKONS**

## CHAPTER FIVE

### A PROFILE OF THE RESEARCH CULTURE AT TECHNIKONS

	PAGE
5.1 INTRODUCTION	204
5.2 INPUT FACTORS	206
5.2.1 Permanent full-time teaching staff with post-graduate qualifications	207
5.2.2 Post-graduate students	210
5.2.3 Financial support by the NRF	214
(a) NRF Grants	
(b) NRF Master's and Doctoral awards	
(c) NRF grant holder-linked and free-standing bursaries	
(d) Industry funding and NRF/THRIP grants	
5.2.4 Concluding remarks	224
5.3 PROCESS FACTORS	225
5.3.1 Master's and doctoral project activity	226
5.3.2 The establishment of focus areas	232
(a) FRD Activity Areas	
(b) The emergence of institutional research focus areas	
(c) Centres of Excellence	
(d) NRF Focus Areas	
(e) The Technology Station Programme	
(f) Alternative institutional structures to focus research	
5.3.3 Concluding remarks	254
5.4 OUTPUT FACTORS	255
5.4.1 Higher degree graduations	256



5.4.2	Higher degree project completion	258
5.4.3	SAPSE unit-earning outputs	260
5.4.4	Papers read at conferences	263
5.4.5	Concluding remarks	264
5.5	CONCLUSION	265

## CHAPTER FIVE

### A PROFILE OF THE RESEARCH CULTURE AT TECHNIKONS

#### 5.1 INTRODUCTION

Chapter Four presented an exposition of the vision of the CTP to establish a research culture at technikons. The technikon sector aimed at enhancing the ability of technikons to provide the South African labour market with the necessary high-level technologically-skilled human resources in the form of technologists. For this purpose, the sector implemented two strategies, namely the advancement of the qualification structure, including initially the Masters and Laureatus Diplomas and eventually the Masters and Doctorate Degrees. The aim of this strategy was two-fold, namely to develop staff and to provide the South African labour market with technologists. The technikon officials hoped to achieve this by adopting an applied research orientation at the post-graduate level. The second strategy was the approach to manage research and the resulting focus area approach to provide momentum to the establishment of a research culture.

Brief reference has already been made to the adoption of an orientation towards industry-based applied research. This orientation formed part of the process of establishing a research culture at technikons which included refining the role, function, scope and nature of research in order to establish a competitive position for technikons in the field of technological knowledge production.

Chapter Five provides a range of statistics aimed at depicting the reality of the vision, strategies and plans of the technikon sector to establish a research culture. In order to allow for a systematic discussion of what is meant by 'research culture', a basic systems framework was developed, as indicated in Figure 2 consisting of input, process and output factors associated with a research culture.

The input factors included both human capital and research funding, with the former referring to both the permanent teaching staff at technikons and full-time postgraduate students and the latter to the master's and doctoral

awards, bursaries and scholarships made available first by the former CSD and FRD and then later by the NRF, as well as the CSD *ad hoc* grants and industry-based NRF/THRIP grants.

The process factors refer to the involvement of both staff and students in higher qualification-based research, as well as the CTP strategy to stimulate the development of focused research.

The output factors mostly display the reality of the vision, strategies and plans, and refer to outputs of research, such as the completed research projects, postgraduate graduations and SAPSE unit-earning research outputs, such as published journal articles and conference proceedings, books and/or chapters in books, technical and research reports, patents and artefacts, as well as papers read at conferences by technikon staff.

The purpose of the chapter is to provide a critical review of the statistics as indicative of the extent to which the technikon sector achieved success in the establishment of a research culture. The discussion addresses the extent of correlation between the statistics and the vision, strategies and plans of the sector, as well as the relation of the different factors to one another. Gibbon (2004:35) presents a recent view of the situation regarding the establishment of a research culture at technikons: "A research culture is supposedly integral to the mission of universities...On the other hand, until relatively recently, research was not considered to be a significant part of the mission of technikons". Gibbon (2004) continues that, in spite of this lack of appreciation, many technikons made advances in the development of niche research areas, as well as improving the qualification profiles of staff.

Essentially, the input and process factors in the systems framework reflect the reality of the resources available for implementing the strategies and plans discussed in Chapters 2, 3 and 4. The output statistics indicate the extent to which the sector was successful in achieving the goal of establishing a research culture by means of implementation of the strategies and plans.

The statistics show that there was not only a gap between the vision, strategies and plans of the technikons officials and the research output, we also note gaps in the profile of the research culture at technikons.

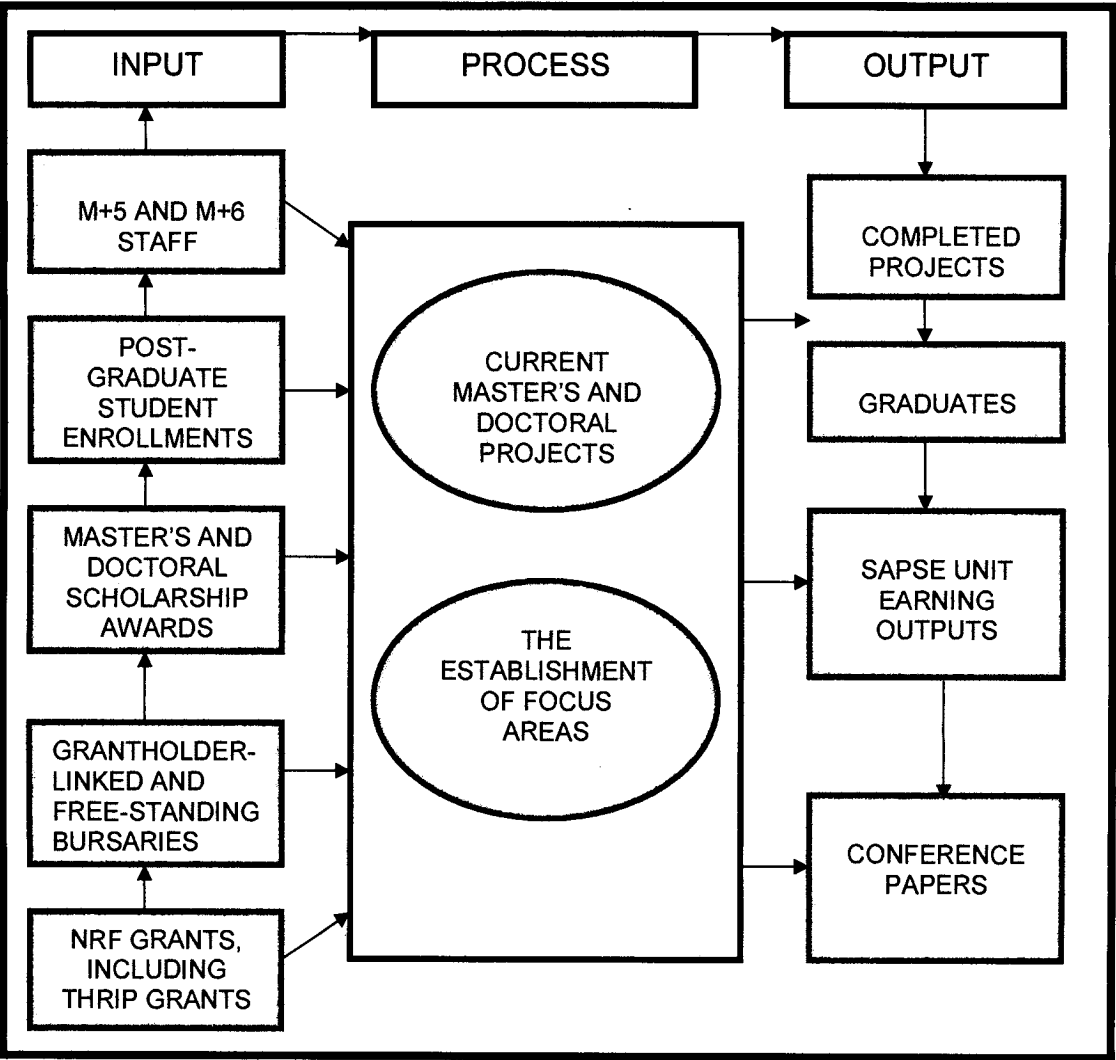


FIGURE 2: A SYSTEMS FRAMEWORK OF THE RESEARCH CULTURE AT TECHNIKONS

5.2 INPUT FACTORS

This section presents quantitative data and statistics relating to the factors available to the technikons for implementation of their plans and strategies to establish a research culture. These factors include the human capital available for research at technikons and the public research funding provided for research at technikons.

The human capital refers to teaching staff and postgraduate students, while the public research funding refers to all the facets of the financial support made available by the NRF.

5.2.1 Permanent full-time teaching staff with post-graduate qualifications

The drive to develop staff, mostly referring to the increase in the number of staff with post-graduate qualifications capable of building staff research capacity, was one of the aims of advancing the qualification structure in order to establish a research culture at technikons. At the same time, the technikons had to utilise those staff with post-graduate qualifications while establishing a culture of research. There are, however, mainly three aspects in connection with the profile of the post-graduate qualifications held by technikon staff that contributed to a challenging situation in terms of utilising staff with post-graduate qualifications in the process of establishing a research culture.

Table 6 quantitatively summarises the post-graduate qualification profile of permanent teaching staff at technikons from 1998 to 2002, drawn from the data from the CTP profiles and the DoE HEMIS database.

TABLE 6: PERMANENT TEACHING STAFF AT TECHNIKONS

Year	Gender					Qualification			
	M	% M	F	% F	Total	M	D	Total	% with M and D
1998	1 896	62	1 182	38	3 078	533	113	646	26
1999	2 062	61	1 308	39	3 370	892	185	1 077	32
2000	2 246	62	1 404	38	3 650	837	192	1 029	28
2001	1 864	60	1 232	40	3 096	893	232	1 125	36
2002	2 254	60	1 504	40	3 758	969	252	1 221	32
Total	10 322	61	6 630	39	16 952	4 124	974	5 098	31

The first aspect in connection with the qualification profile of the teaching staff at technikons is the low number of staff with post-graduate qualifications. Only an average 31% of technikon staff employed during the years 1998 to 2002 actually had post-graduate qualifications.

The second aspect in connection with the qualification profile of teaching staff at technikons is that the overwhelming majority, namely 81 % of the 31% of staff who possessed post-graduate qualifications at the time, had master’s qualifications.

Figure 3 provides an exposition of this situation.

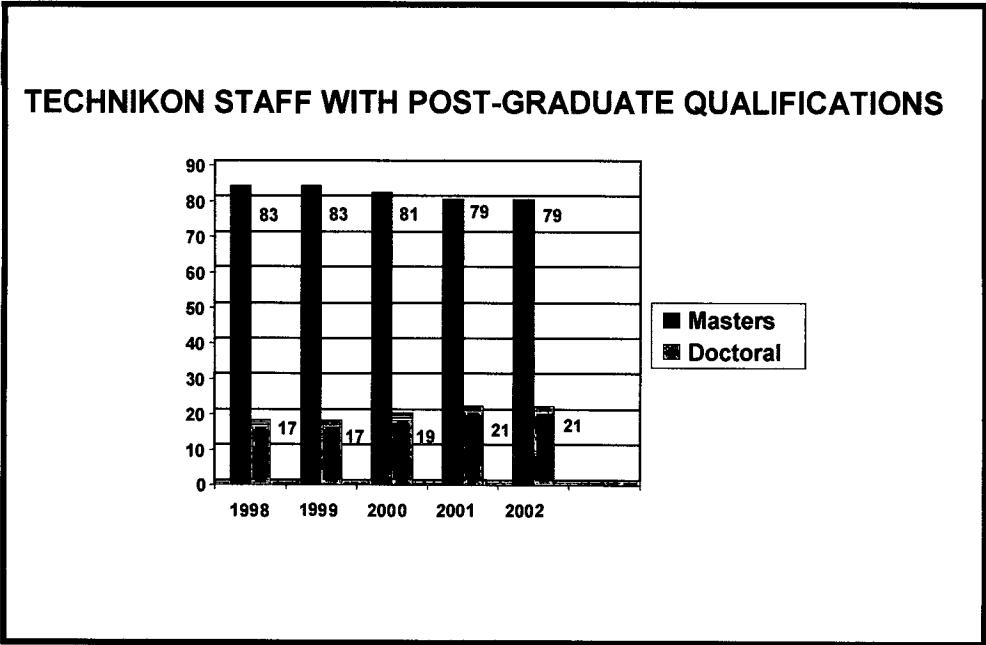


FIGURE 3: TECHNIKON STAFF WITH POST-GRADUATE QUALIFICATIONS

Based on the premise that the technikon sector introduced the advanced degree structure as its main strategy for establishing a research culture, the profile of the post-graduate qualifications of teaching staff as an input factor becomes an issue for concern. The reason for assuming such a position is that only staff with post-graduate qualifications could teach at the post-graduate level and supervise students in completing their research projects. Technikons required that staff should be qualified at least one level higher than the level at which they taught. As mentioned in Chapter Four, both the 1989 and 1998 Research Philosophy documents stated that staff teaching at the M and D levels should be carried out by skilled technology researchers.

If the above requirements were to have been strictly applied, only the 20% of staff with doctoral qualifications could have contributed to the research development of students enrolled at the master's level. The statistics, therefore, reveal that technikon staff at the time lacked sufficient capacity to contribute towards the establishment of a research culture.

According to the General Policy with respect to Technikon Instructional Programmes (NATED Report 151 of 1999), technikons, only four years after the introduction of the higher qualifications, offered 26 Master's Diploma qualifications and 115 M Tech Degree qualifications. The relation between the number of technikon staff with post-graduate qualifications and the number of master's programmes for the period under discussion was not favourable. Whether technikon staff could have been in a position to handle the teaching and supervision requirements of the advanced qualifications is therefore doubtful. Technikon staff traditionally never had to supervise postgraduate students. In addition, as referred to in Chapter Four, the supervisory function was added to an already dense teaching and diverse administrative load.

The third aspect in connection with the qualification profile of the technikon staff refers to the fact that the majority of staff held university post-graduate degrees.

Table 7 indicates that the majority of staff obtained master's degrees issued by universities, as opposed to the M Tech Degrees issued by technikons. The same applied to the doctoral degrees. The reality of the impact of this situation was that the technikon sector had few staff members who could supervise applied research and contribute towards the establishment of an applied research culture and technology transfer.

At the same time, such shortcomings meant that the strategy implemented by the technikon sector aimed at introducing advanced qualifications as a staff development drive in order to build up staff research capacity was unsuccessful.

TABLE 7: PROFILE OF POST-GRADUATE QUALIFICATIONS OF TECHNIKON STAFF

Year	Master's Degree	Doctorate Degree	Master's Diploma	Laureatus Diploma	M Tech Degree	D Tech Degree	Total
1998	432	110	87	1	14	2	646
1999	892*			185*			1 077
2000	695	187	108	0	40	10	1 040
2001	742	274	110	0	51	13	1 190
2002	771	230	118	0	47	15	1 181
Total	2 640	801	423	1	152	40	5 134

\*The 1999 breakdown of technikon staff qualifications have since 2004 and is currently not accessible on the HEMIS page of the Department of Education site.

## 5.2.2 Post-graduate students

Throughout the study, the provision of technologists has been seen to be one of the factors motivating the sector to introduce postgraduate technological degrees. It must be kept in mind that a technologist was considered as a technikon graduate with an M+5 or M+6 qualification.

The enrollment and involvement of staff and students in technological postgraduate degrees was thought to be a way of enhancing both applied research productivity and technological research output, as well as of promoting technology transfer. The strategy for introducing post-graduate technological degrees was therefore not only a strategy to establish a research culture, but also to establish a culture of applied research. This section presents quantitative data indicative of the extent to which both fulltime master's and doctoral students were in a position to contribute to the process of establishing a research culture at technikons.

Table 8 summarises the number of headcount full-time enrollments for master's and doctoral programmes at technikons from 1998 to 2002, as drawn from the statistics of the DoE HEMIS database. The last two columns indicate the total enrollments and the percentage that the master's and doctoral programmes formed of the total enrollments.



The table shows that, on average, only 1% of the total student complement was enrolled at the M Tech or D Tech Degree Level from 1998 to 2002.

TABLE 8: M AND D ENROLLMENTS (HEAD COUNT)

Year	M Dip Tech	M Tech	Total M	Laureatus	D Tech	Total D	Total enrollments	% of total M & D enrollments
1998	68	807	875	2	72	74	194 865	0.5
1999	41	1 210	1 251	2	106	108	197 599	0.6
2000	37	1 644	1 681	1	133	134	202 414	0.9
2001	26	2 362	2 388	0	185	185	210 163	1.2
2002	28	3 086	3 114	1	247	248	214 690	1.6
Total	200	9 109	9 309	6	743	749	1 019 731	1%

While the percentage of enrollments is low, the increase in the number of master's and doctoral degree enrollments should not be overlooked (see Table 9 and Figure 4).

TABLE 9: INCREASE IN MASTER'S AND DOCTORAL ENROLLMENTS

YEAR	% growth in Master's	% growth in Doctorates	Total
1998 – 1999	28	32	30
1999 – 2000	32	19	26
2000 – 2001	31	28	30
2001 – 2002	24	25	25
Total	29	26	28

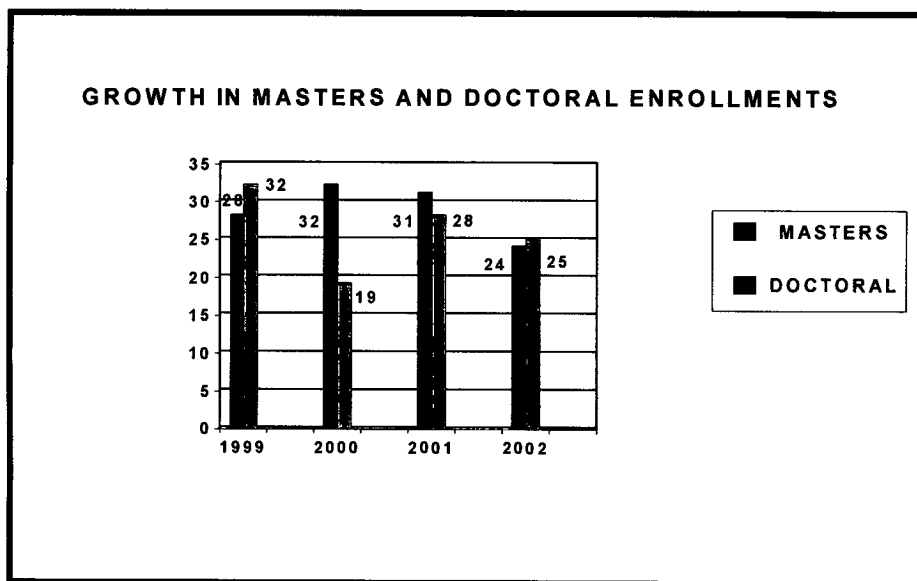


FIGURE 4: GROWTH IN POST-GRADUATE ENROLLMENTS

Table 10 indicates the M Tech Degree enrollments as consisting of an average 35% of students graduating from the B Tech Degree and NHD from one academic year to the next. The growth in the M Tech Degree enrollments is an encouraging factor, especially regarding the exceptionally positive increase in enrollments from 2001 to 2002. However, consideration still has to be paid to the contribution that such students could make towards establishing a research culture.

TABLE 10: M TECH ENROLLMENTS OF NHD AND B TECH GRADUATIONS

Year	Number of NHD/Btech graduates enrolling for M Tech Degrees	Percentage NHD/Btech graduates enrolling for M Tech Degrees	Number of students graduating from the NHD and the B Tech	Year
			3 743	1998
1999	1 210	32	6 080	1999
2000	1 644	27	7 044	2000
2001	2 362	34	6 622	2001
2002	3 086	47		
Total	8 302	35	23 489	Total

The figures also need to be interpreted in the context of the technikon advanced qualification structures.

Such a context refers to the fact that not all programmes offered at technikons have degree status. In addition, in terms of the suite of technikon programmes, the M Tech and D Tech Degree level programmes are restricted in number. At the time, technikons offered 150 National Diplomas and 62 National Higher Diplomas.

Although technikons strove to stimulate the establishment of a research culture by advancing the qualification structure to include technological postgraduate degrees, the question was whether the above-mentioned average increase in postgraduate enrollments of 28% and that of 35% for the B Tech and NHD students progressing to the M Tech Degree could have been sufficient to establish a successful research culture that would place technikons competitively in terms of the production of technological knowledge.

Dividing the total number of M Tech enrollments (8 302) between the number of M Tech Degree programmes offered (115) results in the number of M Tech enrollments consisting of 72 students per programme on average. Dividing this number (72) between the four years, on average 18 students enrolled for each M Tech programme per annum. These figures shed a different light on the capacity of M Tech Degree students to establish a research culture at technikons.

The distribution of the M Tech Degree enrollments between the different CESM categories also reveals interesting trends. Table 11 summarises the figures provided by the DoE HEMIS database. The table, for instance, indicates that the following M Tech Degree CESM categories formed the largest growth areas: Category 7: Education; Category 4: Business, Communication and Management Studies; and Category 9: Health Sciences. These three categories drew 57% of the M Tech Degree enrollments. The engineering-related programmes, which were the initial reason for the introduction of the post-graduate programmes, only took fourth place, with an enrollment figure that of only 54% in relation to the Education and Health Sciences enrollments.

TABLE 11: CESM CATEGORY BREAKDOWN OF M TECH ENROLLMENTS

CESM Category	1999	2000	2001	2002	Total
1 Ag & Renewable Resources	33	61	103	99	296
2 Arch & Env Design	28	26	47	38	139
3 Arts, Visual & Performing	45	57	68	83	253
4 Bus, Comm & Mgt	188	296	448	652	1 584
5 Comm	3	6	10	414	433
6 Comp Sc & Data Proc	25	28	36	84	173
7 Education	112	339	593	613	1 657
8 Eng and Eng Tech	159	171	216	259	805
9 Health Sciences	335	383	388	392	1 498
10 Home Econ	35	32	45	51	163
11 Indus Arts	2	3	4	2	11
12 Language & Linguistics	1	6	8	9	24
13 Law	54	1	55	71	181
14 Libraries, Museums	6	11	14	11	42
15 Life & Physical Sc	74	60	91	71	296
16 Math Sciences	0	0	1	5	6
17 Military Sciences	0	0	0	0	0
18 Phil, Rel & Theology	0	0	0	0	0
19 Physical Ed	0	0	8	7	15
20 Psychology	0	0	0	0	0
21 Pub Admin & Soc Serv	91	148	224	182	645
22 Social Sciences	20	17	7	45	89
Total	1 211	1 645	2 366	3 088	8 310

### 5.2.3 Financial support by the NRF

The third input factor that technikons could use to implement their strategies and plans aimed at establishing a research culture is grants, bursaries and awards made available by the NRF. Four facets of this input factor essentially contributed to the capacity of this factor to contribute to the process of establishing a research culture: the grants; the master's and doctoral awards; the grant-holder linked and free-standing bursaries; and the THRIP grants.

#### (a) NRF Grants

The first facet affecting NRF funding as an input factor that could be used for establishing a research culture at technikons was the NRF Grants. The NRF Grants information is presented in two tables, namely those indicating

the 1999/2000 funding and 2001/2002 funding. Table 12 summarises the details of the Natural Sciences and Engineering Themes and Programme grants and the Social Sciences and Humanities grants, while Table 13 details the focus area funding and the Research Development and support programmes. The presentation of the information is based on the format of publication adopted by the NRF, which reflected the transformed NRF funding structure. Table 13 indicates that the institutional research development was one of the themes of the Natural Sciences and Engineering category. This category has, since 2001, been extended, as is evident in Table 12.

TABLE 12: 1999/2000 NRF TECHNIKON GRANTS

Categories	1999 in R	2000 in R
<b>Natural Sciences and Engineering Themes</b>		
1 Competitive industry	365 000	369 000
2 Improved quality of life	85 000	98 000
3 Sustainable environment	0	0
4 Effective set education	43 300	34 000
5 Building and enhancing research capacity	151 000	201 000
6 National and regional research equipment	0	164 000
7 Institutional research development	<b>10 901 130</b>	<b>11 177 700</b>
<b>Social Sciences and Humanities</b>	192 094	744 200
International science liaison	100 880	136 300
Chair in entrepreneurship		125 000
<b>Total</b>	<b>11 838 404</b>	<b>13 049 200</b>

A comparison of the figures shows a 25% increase in the funds made available for institutional research development from 1999 to 2000.

Table 13, however, indicates a decrease of R1,323 million (12%) in funding for institutional research development from 2000 to 2001, but an increase of R3,385 million (26%) from 2001 to 2002. The NRF, however, implemented two additional research capacity-building programmes, namely REDIBA and Thuthuka, for which funding was provided from 2002 onwards. Table 13 indicates that, overall, the research capacity-building category was allocated the largest portion of the funds, namely 89% in 2001, and 88% in 2002, of the NRF funding granted to institutions.

TABLE 13: 2001/2002 NRF TECHNIKON GRANTS

Categories	2001 in R	% of total	2002 in R	% of total
<b>Focus Areas programmes</b>				
Challenge of globalisation perspectives from the global South	0		0	
Conservation and management of ecosystems and biodiversity	26 000	0.24	25 000	0.16
Distinct South African research opportunities	24 500	0.22	0	0
Economic growth and international competitiveness	83 000	0.75	314 000	2
Education and the challenges for change	0	0	0	0
Indigenous knowledge systems	71 060	0.64	94 500	0.6
Information and communications technology and the information society in South Africa	180 500	1.6	74 000	0.5
Socio-political impact of globalisation	not a 2001 area		0	
Sustainable livelihoods and the eradication of poverty	302 000	2.7	63 000	0.4
Unlocking the future: advancing and strengthening strategic knowledge	251 000	2.3	198 000	1.3
<b>Total focus area funding</b>	<b>938 060</b>	<b>9</b>	<b>768 500</b>	<b>4</b>
<b>Research development and support programmes</b>				
<b>Total institutional research development</b>	<b>9 854 940</b>	<b>89</b>	<b>13 239 880</b>	<b>85</b>
REDIBA	0	0	0	0
Thuthuka	0	0	455 110	3
Research equipment	50 500	0.45	50 000	0.32
International science liaison	225 030	2	872 490	5.6
Chair in entrepreneurship	0	0	200 000	1.3
<b>Total</b>	<b>275 530</b>	<b>3</b>	<b>1 577 600</b>	<b>10</b>
Total all three grant categories	11 068 530		15 585 980	

In the allocation of focus area funding, the low portion of funding allocated for the focus area programmes reflects the low rate of activity in the approved focus areas at the technikons during these two years. There was a decrease of 18% of focus area funding from 2001 to 2002. The most significant focus areas in which funding decreased were those of 'Information and communications technology and the information society in South Africa' (59%) and 'Sustainable livelihoods and the eradication of poverty' (79%). In terms of institutional research development funding, the focus area funding formed 10% in 2001 and 6% in 2002.

In terms of the total funding of grants, the focus area funding formed 9% in 2001 and 4% in 2002.

On the other hand, the allocation for institutional research development in terms of the total amounts granted was 89% in 2001 and 85% in 2002. The slight decrease of 4% for institutional research development can mainly be ascribed to the preparations made to add two institutional research development categories, namely REDIBA and Thuthuka, in 2002.

b) NRF Master's and Doctoral awards

The second facet of the NRF funding as an input factor for the establishing of a research culture at the technikons was the NRF master's and doctoral awards. Table 14 lists the awards made to technikons by the CSD in 1998 and by the NRF from 1999 to 2002.

TABLE 14: MASTER'S AND DOCTORAL AWARDS

Year	No. of M grants	Total amount in Rand	No. of D grants	Total amount in Rand	Total no. of grants	Total amount in Rand
1998	38	342 000	13	169 000	51	511 000
1999	23	207 000	19	247 000	42	454 000
2000	28	336 000	23	483 000	51	819 000
2001	85	814 000	34	662 000	119	1 476 000
2002	34	340 000	19	386 000	53	726 000
Total	208	2 039 000	108	1 947 000	316	3 986 000

The figures show that a total of R3,986 million was awarded to master's and doctoral students during the set period. Table 15 and Figure 5 indicate the percentage increases and/or decreases in the total amounts awarded from 1998 to 2002.

TABLE 15: ANNUAL DISTRIBUTION OF MASTER'S AND DOCTORAL AWARDS

Year	Total amount	Percentage increase/decrease
1998 to 1999	R57 000.00 -	-11
1999 to 2000	R365 000.00 +	+45
2000 to 2001	R657 000.00 +	+45
2001 to 2002	R750 000.00 -	-51

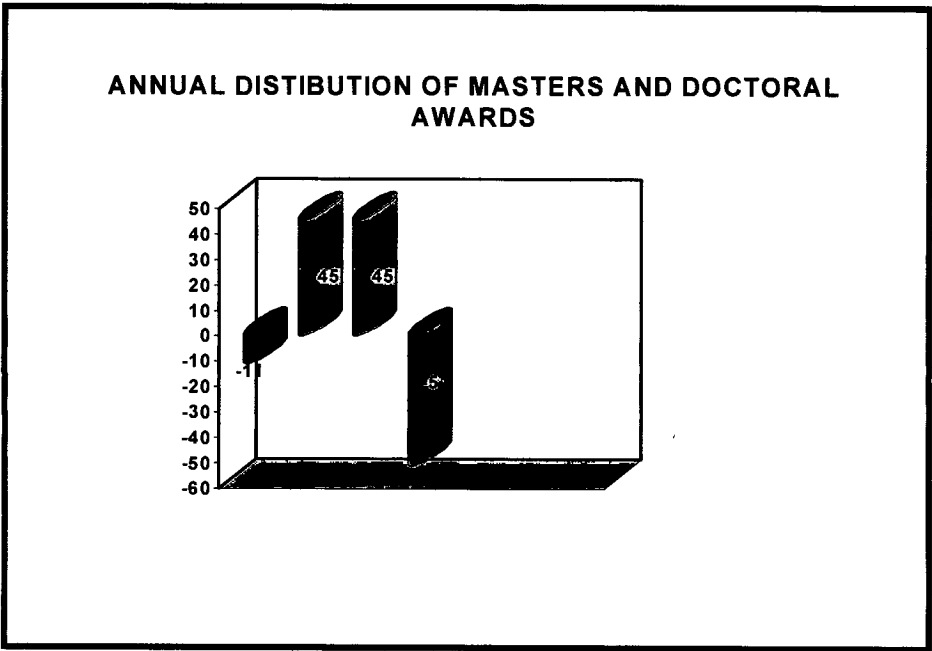


FIGURE 5: ANNUAL DISTRIBUTION OF MASTER'S AND DOCTORAL AWARDS

Tables 16 and 17 present an analysis of the average amount granted per postgraduate student and the number of grants in comparison with the number of students, which indicates a significant drop in the value of grants in regards to 2002.

TABLE 16: AVERAGE AMOUNT OF FUNDING PER STUDENT

Year	Total amounts in Rands	Average amount in Rands per student	Number of students
1999	454 000	334	1 359
2000	819 000	451	1 815
2001	1 476 000	573	2 573
2002	726 000	215	3 362
Total	3 475 000	393	9 109

An average of R393.00 per annum per enrolled student was awarded in the NRF master's and doctoral awards category. The lowest amount, namely R215.00, was awarded per student in 2002. The decline in funding was caused by two factors, namely a decrease of R750 000, as well as an increase of 789 students from 2001 to 2002.



Table 17 shows that the actual number of grants more than doubled from 51 to 119, more than double, from 2000 to 2001, meaning that the actual value per grant was less in 2002 than it had been in preceding years.

In terms of the capacity of the students as input factor utilised towards establishing a research culture, it is important to establish whether it is better to assist more students with decreased funding or fewer students with increased funding.

**TABLE 17: NUMBER OF GRANTS IN COMPARISON WITH NUMBER OF STUDENTS**

<b>Year</b>	<b>Number of grants</b>	<b>Number of students</b>
1999	51	1 359
2000	42	1 815
2001	51	2 573
2002	119	3 362
Total	316	9 109

The average number of grants awarded by the NRF between 1999 and 2002 was 79. If the number of grants were to be split up in accordance with the number of students enrolled for postgraduate qualifications, only 4% of all students enrolled for master's and doctoral studies at technikons from 1999 to 2002 appear to have been supported by master's and doctoral awards granted by the NRF. Such funding would not have significantly enhanced the students' capacity as an input factor contributing to the establishment of a research culture. The statistics show that, in real terms, a very small financial contribution was made by the NRF towards the establishment of a research culture at technikons from 1999 to 2002 as far as student bursaries were concerned, despite a significant dependence of the technikons on NRF funding.

The annual research reports of the various technikons indicated that very few technikons offered bursaries or any other kind of financial support to postgraduate students during the period under review.

## (c) NRF grant holder-linked and free-standing bursaries

The third facet of the NRF funding as an input factor to use towards the establishment of a research culture at technikons is the NRF grants.

Table 18 presents the data for the free-standing master's and doctoral bursaries, as well as for the grant-holder linked master's and doctoral bursaries. The figures are once again low in comparison with the number of students enrolled for postgraduate qualifications at technikons, especially in the case of the free-standing bursaries.

TABLE 18: MASTER'S AND DOCTORAL BURSARIES

Year	Doc FS	Doc GH	Amount Rands	Masters FS	Masters GH	Amount Rands	Total grants	Total amount Rands
1999	0	27	483 500	0	106	1 152 400	133	1 635 900
2000	2	19	431 094	0	128	1 331 476	149	1 762 570
2001	2	23	467 548	0	160	1 819 162	185	2 286 710
2002	5	36	707 000	27	147	2 256 332	215	2 963 332
Total	9	105	2 089 142	27	541	6 559 370	682	8 648 512

The annual average of all four of the above categories ( $9 + 105 + 27 + 541$ ) amounts to 170.5 bursaries. On average, there were 2.25 freestanding doctoral bursaries and 6.75 freestanding master's bursaries awarded per annum in the period under review. The average for the grant-holder linked doctoral bursaries per annum was 26.25 and the annual average grant-holder-linked master's bursaries was 135.25. If the total annual average of master's and doctoral awards and the annual average freestanding and grant-holder-linked bursaries are added, namely 79 and 170.5, the total amounts to 249.5 grants of some form or other. If this figure is divided by the number of postgraduate enrolled students, the earlier-mentioned 4% of all students enrolled for master's and doctoral studies at technikons from 1999 to 2002 and supported by the NRF, shows an increase to 5.5%. However, the steady increase in the number of master's and doctoral bursaries allocated should not be overlooked. Table 19 summarises the increases, as indicated in Figure 5.

TABLE 19: ANNUAL INCREASE IN MASTER’S AND DOCTORAL BURSARIES

	Master’s bursaries	Doctoral bursaries
From 1999 to 2000	+ 22	– 6
From 2000 to 2001	+ 32	+ 4
From 2001 to 2002	+ 14	+ 16
Average annual growth	23	6

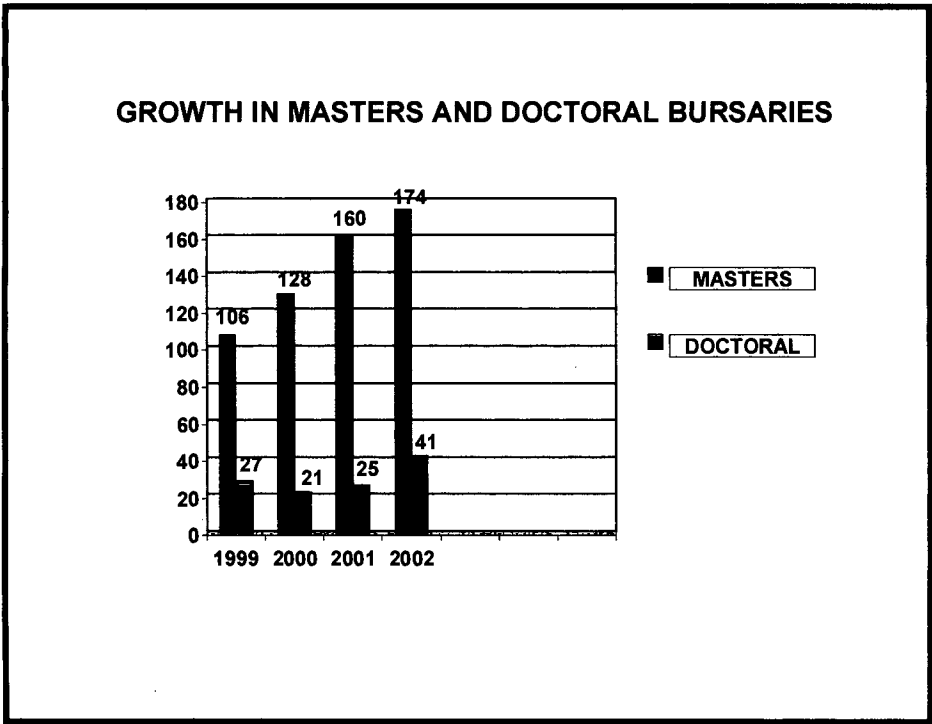


FIGURE 6: GROWTH IN MASTER’S AND DOCTORAL BURSARIES

(d) Industry funding and NRF/THRIP grants

The fourth facet of the NRF funding as an input factor to use towards establishing a research culture at technikons is the NRF grants. Tables 20 and 21 present information on the grants awarded through the Technology and Human Resources in Industry Programme (THRIP) of the NRF. The tables indicate the number of THRIP grants and industry partners, as well as the amounts of THRIP grants and industry partners for the period 1998 to 2002. THRIP grants are allocated according to the THRIP priorities, which are:

- to support an increase in the number of black and female students who intend to pursue technological and engineering careers;

- to promote technological know-how within the small, medium and micro enterprise sector, through the deployment of skills vested in HEIs and SETIs;
- to facilitate and support multi-firm projects in which firms collaborate and share in the project outcomes; and
- to facilitate and support the enhancement of the competitiveness of black-owned enterprises through technological and human resource development.

TABLE 20: INDUSTRY NRF/THRIP GRANTS

Year	Number of grants	% of total grants per annum	Amounts of THRIP grants	% of total amounts per annum
1998	25	20	R11 620 000	14
1999	31	26	R24 849 000	29
2000	25	20	R13 897 232	16
2001	25	20	R4 263 979	5
2002	17	14	R30 078 702	36
Total	123	100	R84 708 913	100

TABLE 21: INDUSTRY NRF/THRIP PARTNERS

Year	Number of partners	% of partners for 1998 – 2002	Amounts granted by partners (R)	% of amounts by partners per annum
1998	43	19	11 955 400	11
1999	57	25	31 501 044	28
2000	59	26	17 854 429	16
2001	41	17	11 896 473	10
2002	28	13	38 492 607	35
Total	228	100	111 699 953	100

The above tables indicate a steady provision of grants from 1998 to 2001, with quite a decline in 2002, as well as a fairly high number of industry partners for the same period, with once again a decline in the number of partners in 2002. Only R4 263 979.00 was granted in the form of 25 grants in 2001, in comparison with more or less the same number of grants accorded much higher amounts in the other years.

At the same time, the number of partners in 2001 was 41, with a financial contribution of only R11 896 473, whereas in the next year, 28 partners contributed R38 492 607.00.

Table 22 shows an annual institutional breakdown of projects funded with THRIP grants. Each of the columns indicates the number of THRIP grant holders (G) and the number of industry partners (P) in a specific year.

- The data in the Natal 2002 column consist of the figures for the Durban Institute of Technology.
- Pretoria Technikon obtained the collaboration of 58 industry partners, followed by Port Elizabeth and Natal with 26, the Cape Technikon with 25 and the Free State with 24.
- The four technikons with the highest number of grants were: Pretoria, with 28 grants; the Cape Technikon, with 17 grants; Port Elizabeth, with 12 grants; and Natal with 12 grants.

TABLE 22: THRIP-FUNDED PROJECTS

	1998		1999		2000		2001		2002		T G	T P
	G	P	G	P	G	P	G	P	G	P		
Technikon												
Border	0	0	0	0	0	0	0	0	0	0	0	0
Cape	3	5	4	4	4	10	3	3	3	3	17	25
E Cape	1	2	1	2	0	0	0	0	0	0	2	4
Free State	4	7	3	9	1	5	0	0	1	3	9	24
Mangosutho	0	0	0	0	0	0	0	0	0	0	0	0
M L Sultan	2	3	4	4	2	4	1	2	0	0	9	13
Natal	1	1	2	6	3	7	2	6	4	6	12	26
N Gauteng	2	2	2	4	1	7	1	2	1	2	7	17
N West	1	2	1	2	1	2	0	0	0	0	3	6
Peninsula	3	3	3	4	2	3	0	0	0	0	8	10
P Elizabeth	3	6	2	8	2	4	3	5	2	3	12	26
Pretoria	4	11	7	10	3	10	9	17	5	10	28	58
TSA	0	0	1	2	0	0	0	0	0	0	1	2
V Triangle	1	1	0	0	0	0	3	2	1	1	5	4
Wits	0	0	1	2	6	7	3	4	0	0	10	13
Total	25	43	31	57	25	59	25	41	17	28	123	228

An analysis of the growth in the total number of grants and the number of industry partners for the sector during the period under review revealed that there was a 19% growth in the number of grants awarded from 1998 to 1999.

While there was a decline of 24% in the grants awarded from 1999 to 2000, the number of grant holders for 2001 was the same as in 2000. The number of grants awarded declined by a further 32% from 2001 to 2002. There was a 25% increase in the number of industry partners from 1998 to 1999; a 3.4% increase from 1999 to 2000; a decrease of 30.5% from 2000 to 2001; and a 32% decrease from 2001 to 2002.

If the number of THRIP grants (98) made available by the NRF from 1999 to 2002 is divided by the four years in question, the annual average of THRIP grants amounts to 24.5. When dividing R54 630 211.00 by the number of grants, namely 123, each grant amounts to R444 148.00.

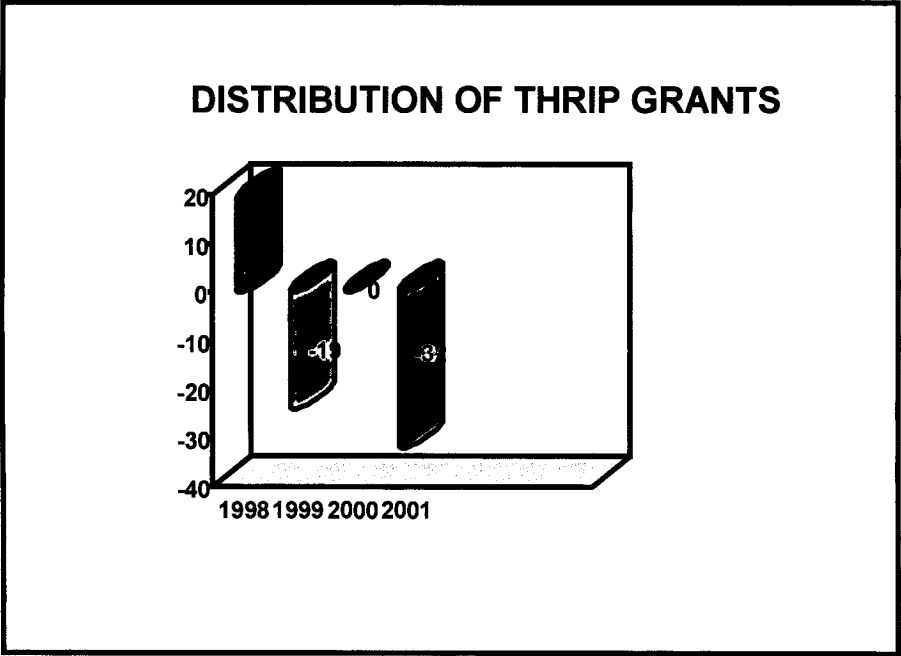


FIGURE 7: DISTRIBUTION OF THRIP GRANTS

5.2.4 Concluding remarks

Section 5.2 dealt with the input factors that technikons had available to utilise in establishing a research culture from 1999 to 2002. The purpose of the discussion was to provide a statistical profile of the extent to which these factors could significantly contribute to the implementation of the strategies and plans aimed at establishing a research culture.

The statistics show that the establishment of a research culture was always a daunting prospect, due to the shortage of the necessary research capacity in terms of human resources. While only 31% of staff during this period had a postgraduate qualification, only 1% of the total student population and 35% of the NHD and B Tech Degree graduates enrolled for postgraduate qualifications. In order to strengthen the pool of human resources, the NRF provided funding in various categories. However, a comparison of the funding amounts awarded with the number of postgraduate students enrolled once again underlines the challenge faced by technikons in having to establish a research culture, and especially an applied and industry-oriented problem-solving one.

### 5.3 PROCESS FACTORS

Two factors were identified as being most significant in terms of the process of implementing the plans and strategies of the sector to establish a research culture: the registration of master's and doctoral projects and the adoption of the focus area approach. The continuous registration of research projects It was envisaged as creating a climate conducive to research and to the enhancement of research activity, and as leading to a culture of research that would increase research output.

As mentioned in the introduction, discussion of the statistics for the period from 1999 to 2002 allows for the critical review of the correlation existing between the actual data from the period and the intention, plans and strategy that the sector implemented in order to establish a research culture. A statistical analysis allows assessment of the extent to which the factors involved indeed facilitated implementation of the plans and strategies of the sector aimed at establishing a research culture.

In terms of the relation existing between the input factors and the process of establishing a research culture, it is noteworthy that the technikon sector engaged in a process of establishing a research culture with the following input factors:

- The majority of staff members at that stage had obtained their postgraduate qualifications at universities and not at technikons.
- Of the 31% of permanent fulltime teaching staff holding post-graduate qualifications at the time, only 20 % held doctorates.
- Only 18 students enrolled for M Tech Degree programmes on average per annum, and even fewer for D Tech Degree programmes. The majority (57%) of the M Tech Degree enrollments were concentrated around the following CESM categories: Business, Communication and Management Studies; Education; and the Health Sciences.
- In terms of the total number of grants awarded, the focus area grants formed 9% in 2001 and 4% in 2002, whereas the allocation to institutional research development in terms of the total amounts granted was 89% in 2001 and 85% in 2002.
- An average of R393 per annum was granted per enrolled postgraduate student, providing sufficient funding for only 4% of the enrolled postgraduate students, was awarded in the NRF master's and doctoral awards category.
- An annual average of 26.25 grant-holder-linked doctoral bursaries and 135.25 grant-holder-linked master's bursaries was awarded.
- An annual average of 24.5 THRIP grants was awarded.

#### 5.3.1 Master's and doctoral project activity

The first process factor consists of the master's and doctoral projects. To critically review this part of the process of establishing a research culture at technikons, the quantitative profile of postgraduate projects current from 1984 to 2002 is discussed.

The figures for the period from 1984 to 1998 represent the current master's and doctoral projects on 14 December 1999, when the CTP documented the data available on the NAVTEC database, as maintained by the Free State Technikon. The profile in question firstly indicates the level of activity of projects across the following postgraduate qualifications: M Dip Tech, the Laureatus Diploma, the M Tech Degree and the D Tech Degree projects current from 1984 to 2002.



Secondly, the increase in M Tech projects, as opposed to M Dip Tech project registrations from 1996 to 1998, as well as the tremendous growth in the number of M Tech and D Tech enrollments from 1999 onwards, demonstrates the favourable way in which technikons responded to the research challenge concerned.

TABLE 23: CURRENT PROJECTS FROM 1984 TO 2002

Year of Registration	M Dip Tech	Laureatus	M Tech	D Tech	Total
1984	1	1	0	0	2
1985	1	1	0	0	2
1986	2	3	0	0	5
1987	18	0	0	0	18
1988	40	1	0	0	41
1989	29	0	0	0	29
1990	47	1	1	0	49
1991	92	0	0	0	92
1992	70	2	4	0	76
1993	286	6	0	0	292
1994	70	2	9	2	83
1995	87	2	38	7	134
1996	31	0	43	10	84
1997	12	0	34	2	48
1998	3	0	45	4	52
1999	41	2	1 120	106	1 269
2000	37	1	1 644	133	1 815
2001	26	0	2 362	185	2 573
2002	28	1	3 086	247	3 362
<b>Total</b>	<b>921</b>	<b>23</b>	<b>8 386</b>	<b>696</b>	<b>10 026</b>

Despite the seemingly overwhelming decrease in the registration of M Dip Tech projects in 1998, the figures on the DoE HEMIS database indicate that only 68 students were enrolled for the M Dip Tech qualification in 1998. The 'increase' in M Dip project activity could therefore have merely reflected improved database practices. At the same time, it should be remembered that students on the master's and doctoral level in most instances completed their projects over a period longer than one year, which also served to influence the enrollment figures provided by the DoE for the period under review.

The figures from 1999 to 2002 represent the master's and doctoral enrollments for those years.

The year of registration of the projects does therefore not necessarily apply to those figures. The rationale for the inclusion of the master's and doctoral enrollment figures as part of the projects current for the period, is that all master's and doctoral degree enrollments were based on a research project, even though some master's students completed projects in partial fulfillment of the degree.

The projects indicated as current from 1984 to 1998 did not differentiate between staff and student projects and the decline in the number of M Dip Tech projects from 1995 to 1999 related to the introduction of the M Tech Degree at technikons in 1995. When compared with the data provided in Column 4, the decline in the M Dip Tech Projects is, in essence, counteracted by an attendant increase in the number of M Tech projects.

In addition, there was an increase in non-degree-based research. The emphasis from 1984 to 1998 was on research for the purpose of obtaining a higher qualification, so that the majority of projects were conducted with this purpose in mind. The number of *ad-hoc* projects for this period was less than 20 (CTP, 1999).

Individual technikons did not adopt a uniform format for their annual research reports, which made it difficult to differentiate between degree-based and *ad-hoc* projects. As a result, an overview of the figures of the current projects from 1999 to 2002 is provided, as reported upon by the various technikons in their annual research reports. Due to the inconsistent reporting style of the technikons at the time, no accurate data could be extracted for degree-based current projects for the period under review. The first row of Table 24 therefore indicates the master's and doctoral enrollments indicated in Table 23 above. The information contained in the second row consists of a subtraction of these numbers from the projects reported upon in the technikon annual research reports, as well as the student and staff non-degree projects current at the time. In this way, an attempt has been made to estimate the number of degree-based projects current during those years.

TABLE 24: CURRENT PROJECTS FROM 2000 TO 2002

	2000	2001	2002	Total
M and D enrollments	1 815	2 573	3 362	7 750
Estimated number of current degree-based projects	594	89	950	1 633

The growing participation of staff and students in non-degree research projects was an indicator of a stronger research culture. However, the importance of completing these projects was not given as much attention as it should have been in technikon research reports, which tended to pay much less attention to the completion of projects than they did to ongoing projects.

Another important aspect that cannot be ignored is the technikons' contribution to technological human resources, namely technologists, for the South African labour market, a factor referred to earlier in the chapter. To determine the state of affairs regarding this, an analysis was undertaken of the current master's and doctoral research projects from 1984 to 1998 according to the CESM categories. The purpose of this analysis is to display the distribution of the technikon sector's technological human resourced output, meaning the provision of technologists. CESM categorisation is performed in terms of the system used by the DoE for classifying subject matter in educational fields.

As mentioned in Chapter Two, upon receipt of the Goode Commission's report in the early 1980s, a gap was identified as existing in the South African labour market between the technician and engineer levels. In response to this identification, the technikon sector introduced two postgraduate diploma qualifications to address the shortage of skilled technologists.

Chapter Four indicated that the aim of introducing these two qualifications was to provide the job market with sufficient human resources, capable not only of identifying problems, but also of solving problems.

The gap between the engineer and technician levels was the initial reason for the introduction of the advanced qualifications at technikons.

The conceptualisation of the technologist as a holder of a master's or doctoral qualification in the other vocational fields established itself as the programmes developed and it was realised that the South African labour market needed human resources with the ability both to identify and to solve problems. This realisation also stimulated the development of the other technikon postgraduate qualifications, as well as of the postgraduate degree structure.

In 1993, the Master's Diploma in Technology and the Laureatus were converted to the Master's Degree in Technology and the Doctorate Degree in Technology, with research concomitantly becoming a more prominent feature of technikon postgraduate studies.

For the purpose of the current analysis, only the 22 broad categories were used to indicate the technological nature of research undertaken at technikons from 1984 to 1998. Only those categories in which the technikons had projects were tabulated.

An analysis of the projects databased by the CTP according to the CESM categories highlights that the largest number, namely 539, of projects current from 1984 to 1998 were engineering-related projects. This number represents an average of 36, the largest number, of engineering-related projects for each of the fifteen years concerned.

However, when calculated as a percentage of the total number of projects, this number represented 52.6%, just more than half of the current projects. The result of such a calculation means that the remaining 47.4% was distributed between the other 15 categories referred to in the table.

**TABLE 25: CLASSIFICATION OF PROJECTS IN CESM CATEGORIES (1984 – 1998)**

CESM CATEGORY	NUMBER OF PROJECTS
1 Agricultural and Renewable Natural Resources	8
2 Architecture and Environmental design	6
3 Arts, Visual and Performing	30
4 Business, Commerce and Management Sciences	109
5 Communication	1
6 Computer Sciences and Data Processing	27
7 Education	36
8 Engineering and Engineering Technology	539
9 Health Care and Health Sciences	162
10 Home Economics	11
11 Industrial Arts, Trades and Technology	1
15 Life Sciences and Physical Sciences	85
17 Military Sciences	1
19 Physical Education, Health Education and Leisure	2
21 Public Administration and Social Services	6
Total	1 024

Table 26 shows the student enrollments for master's and doctoral degree qualifications in CESM category 8 for 2000 to 2002. The figures given for the MTech and DTech projects for the three years indicate a steady annual increase in engineering-related projects. The table also indicates the annual averages for each of the categories of the projects concerned.

**TABLE 26: MASTER'S AND DOCTORAL ENROLLMENTS IN CESM CATEGORY 8**

YEAR	M TECH	DIP	M TECH	LAUREATUS	D TECH	TOTAL
2000	22		171	0	44	237
2001	15		216	0	45	276
2002	3		259	0	63	325
TOTAL	40		646	0	152	838
ANNUAL AVERAGE	13		215	0	50	70

Doubt exists as to whether the process of establishing a research culture, especially an applied one, could have been successfully implemented with the amount of research activity indicated in Table 25.

### 5.3.2 The establishment of focus areas

The focus area approach to research was advocated by the CTP and published in *The Guidelines for the implementation for research and development programmes at technikons*. *The Guidelines* basically resulted from the 1998 Research Philosophy of the CTP and described the route for technikons to follow in order to develop the sector's research capacity. The DoE, already in 1997, referred to the prioritising of government funding according to certain focus areas. In addition, the NRF, as part of an initiative to build research capacity at technikons, developed the Technikon Programme with a focus area funding programme in 2001. The NRF located the Centres of Excellence "...at the pinnacle of the FAP framework...designed to raise the research and capacity development ceiling of already existent top level scientists and further enhance their contribution to regeneration of the broader science community" (NRF, 2003:1). This initiative was in line with the vision of the CTP for a research culture at technikons, as discussed in detail in Chapters Three and Chapter Four.

One of the motivators behind both these initiatives was the greater demand for accountability regarding state expenditure on research. The rationale was that a more focused approach to research would concentrate research expertise and contribute to a more directed approach to the utilisation of research funding.

The discussion sets out the process of focusing research across the technikons, providing commentary on the way in which technikons responded to the approach of focusing research, especially in light of the fact that the focusing of research formed part of the process aimed at establishing a research culture.

The discussion should be interpreted in the context of the focus area funding made available by the NRF which already, as seen earlier, indicated a certain level of activity.

Especially noteworthy was the development of focus areas, especially the establishment of institutional Centres of Excellence in some of the technikons, which was, in many instances, (a) not part of the initial NRF drive, and (b) outside the initial NRF conceptual and funding framework.

The discussion includes the establishment of FRD Activity and NRF Focus and Niche Area developments, as well as of Centres of Excellence at technikons, along with the development of institutional focus areas. The discussion also covers the establishment of additional types of organisational forms providing a focused approach to research development, as well as to the Technology Station programme.

(a) FRD Activity Areas

This section of the thesis provides an exposition of the development of FRD research activity areas, as reported upon by the various technikons in its Annual Research Reports. The discussion of the FRD activity areas ends in a full list of activity areas at all fifteen technikons, as approved in 2001. Reporting by technikons on this very important strategy to implement the vision and plans of the CTP for establishing a research culture at technikons on institutional level was regarded as relatively insignificant.

A single FRD-funded activity area was approved at the Border Technikon in 1997. The activity area in question was located in the Department of End-user Computing, with the focus of research being effective SET education. With the introduction of the new focus area funding programme of the NRF, this activity area came to an end and collaboration in this particular area of research was established between this department and the Port Elizabeth Technikon. At the time of compilation of this thesis, the Border Technikon had no NRF-funded focus areas.

At Port Elizabeth Technikon, seven FRD-funded activity areas were established in 1997, consisting of:

- chemistry of materials;
- information security;
- manufacturing technology;

- renewable energy;
- SET education;
- forestry; and
- food and farming security.

TABLE 27: FRD ACTIVITY AREAS FOR 1997

Institution	Number of FRD Activity Areas
Border Technikon	1
Port Elizabeth Technikon	7
Total	8

In 1998, the Vaal Triangle Technikon developed three focus areas for submission to the FRD for funding, namely: Human resources for small, medium and micro enterprises; Environmental chemistry; and Electrical power cables. By the end of 1998, the Witwatersrand Technikon had developed and submitted the following six activity areas to the FRD for funding:

- casting technology;
- food safety and security;
- urban open spaces;
- design, material, and manufacturing;
- enhancing production efficiency; and
- optimising delivery of physical infrastructure.

TABLE 28: FRD ACTIVITY AREAS FOR 1998

Institution	Number of FRD Activity Areas
Vaal Triangle Technikon	3
Technikon Witwatersrand	6
Total	9

The Witwatersrand Technikon activity areas, which were either approved for funding by the NRF or which were close to meeting with final approval by the end of 1999, were:

- casting technology;
- the technology of cereal, tuber and legume foods;
- occupational and environmental radiation assessment;



- urban open spaces;
- integrating design, materials and manufacturing; and
- optimising delivery of physical infrastructure.

In 1999, the Vaal Triangle Technikon developed a further activity area, titled, 'Development of functional foods', for the purposes of submitting to the NRF for funding.

TABLE 29: NRF ACTIVITY AREAS FOR 1999

Institution	Number of NRF Focus Areas
Vaal Triangle Technikon	4
Technikon Witwatersrand	6
Total	10

By the end of 2000, the following activity areas were approved for NRF funding at the Vaal Triangle Technikon:

- the development of functional foods;
- environmental chemistry;
- electrical power cables, power quality and electrical machines;
- engineering vibration; and
- fluid-thermal system technology development and optimisation.

At the Witwatersrand Technikon, the following activity areas received NRF funding during 2000:

- environmental and occupational radiation exposure;
- casting technology;
- optimal delivery of the constructed environment; and
- technology of legume, tuber and cereal foods.

TABLE 30: NRF ACTIVITY AREAS FOR 2000

Institution	Number of NRF Focus Areas
Vaal Triangle Technikon	5
Technikon Witwatersrand	4
Total	9

The quantitative distribution of activity areas across the technikon sector in January 2001 was as follows:

TABLE 31: NRF ACTIVITY AREAS FOR 2001

Technikon	Number of approved activity areas in 2001
Border	1
Cape	3
Eastern Cape	1
Free State	4
Mangosutho	2
ML Sultan	5
Natal	4
Northern Gauteng	2
North West	1
Peninsula	6
Port Elizabeth	7
Pretoria	9
SA	1
Vaal Triangle	5
Witwatersrand	4
Total	55

(National Research Foundation, 2001(b):1)

(b) The emergence of institutional research focus areas

The Cape Technikon responded to the CTP-driven focus area approach early and had 14 established focus areas among the six academic schools by 1998.

TABLE 32: CAPE TECHNIKON RESEARCH FOCUS AREAS 1988–1998

School of Architecture and Building	<ul style="list-style-type: none"> <li>• Urban Housing Unit</li> </ul>
School of Civil Engineering	<ul style="list-style-type: none"> <li>• Slurry Flow Research Unit</li> <li>• Community Infrastructure Programme</li> </ul>
School of Electrical Engineering	<ul style="list-style-type: none"> <li>• Centre for Instrumentation Research</li> <li>• Centre for Power System Harmonic Field Measurements, PC Simulation and Standards</li> <li>• Energy Technology Unit</li> </ul>
School of Mechanical and Process Engineering	<ul style="list-style-type: none"> <li>• Chemistry Research Unit</li> <li>• Chemical Engineering Unit</li> <li>• Food Technology Unit</li> <li>• Plastics Technology Unit</li> <li>• Mass Spectrometry Unit</li> </ul>
School of Life Sciences	<ul style="list-style-type: none"> <li>• Drug Delivery Systems Research Unit</li> <li>• "Edugreen" – unit in the Department of Horticultural Studies</li> </ul>
School of Management	<ul style="list-style-type: none"> <li>• Tourism Research Unit</li> </ul>

The Schools were consolidated into faculties, and for the period from 1999 to 2002, 12 institutional focus areas were active among the five units displayed in Table 32. The two tables seem to indicate that sufficient research capacity was present in all the Schools to focus research in a number of areas, with the most capacity being in the field of engineering.

The School of Electrical Engineering and Mechanical and Process Engineering came together in the Faculty of Engineering and a much more streamlined, focused approach to research came about with the establishment of the Flow Process Research Centre and the Centre for Instrumentation Research.

TABLE 33: CAPE TECHNIKON FOCUS AREAS FOR 1999 – 2002

Faculty of Applied Sciences	<ul style="list-style-type: none"> <li>• Horticulture</li> <li>• Conservation Farming</li> <li>• Food Technology</li> <li>• Biomedical Technology</li> <li>• Nursing</li> <li>• Environmental Health</li> </ul>
Faculty of Built Environment and Design	<ul style="list-style-type: none"> <li>• Sustainable Urban and Housing Development Unit</li> <li>• Richtersveld Arts and Craft Centre</li> </ul>
Faculty of Engineering	<ul style="list-style-type: none"> <li>• The Flow Process Research Centre</li> <li>• Centre for Instrumentation Research</li> </ul>
Faculty of Management	<ul style="list-style-type: none"> <li>• Tourism Research Unit</li> </ul>
Research Development	<ul style="list-style-type: none"> <li>• Energy Technology Unit</li> </ul>

In 1999 the Free State Technikon had 16 established areas of research focus more or less evenly spread out between the Faculties of Applied Sciences and Management. Two of the areas that fell within the Faculty of Applied Sciences already received NRF funding in 1999, continuing to become part of the approved FRD activity areas in 2001, namely those of food and nutrition and water quality management.

TABLE 34: FREE STATE FOCUS AREAS FOR 1999

Faculty of Applied Sciences	<ul style="list-style-type: none"> <li>• Programme for Food and Nutrition (funded by the NRF)</li> <li>• Water Quality Management Programme (funded by the NRF)</li> <li>• Programme for Occupational Health and Safety (funded by the NRF)</li> <li>• Fibrinogen Unit</li> <li>• Programme for Industrial Electronics</li> <li>• Programme for Agriculture</li> <li>• Centre for Rapid Prototyping and Manufacturing</li> </ul>
Faculty of Management	<ul style="list-style-type: none"> <li>• Programme for Distance Education</li> <li>• Programme for Government Management</li> <li>• Applied Programming</li> <li>• MBA Audit Psychology</li> <li>• Wealth Tax</li> <li>• Vergelyking van Eerste en Derdewêreld Belastingstelsels</li> <li>• Staff Development Programme for Technological Universities</li> <li>• Impact of Minimum Wages on Employment Levels of Domestic Workers</li> <li>• Coping with Stress in Examination Sections at HEIs</li> </ul>

From the titles provided for the programmes at the Free State Technikon during 1999, it seems as if some of the so-called 'programmes' were, in fact, projects rather than programmes.

Nevertheless, the inclusion of such programmes indicated that the Free State Technikon, as early as 1999, was already attempting to focus its research efforts. Such a conclusion is based on the way in which the research programmes were reported on in the 2000 Annual Research Report, in accordance with the following focus:

- the rapid prototyping and manufacturing programme;
- the electronic sensing and control programme;
- the water quality and water resource management programme;
- the agriculture programme;
- the food and nutrition programme; and
- the fibrinogen programme.

TABLE 36: VAAL TRIANGLE TECHNIKON FOCUS AREAS FOR 1999

Faculty of Applied and Computer Sciences	<ul style="list-style-type: none"> <li>• Environmental chemistry</li> </ul>
Faculty of Engineering	<ul style="list-style-type: none"> <li>• Electrical power cables, power quality and electrical machines</li> </ul>

The projects active in the environmental chemistry focus area were:

- infrared analysis of the air in an industrial environment;
- microbial removal of heavy metals from metal-content effluent;
- chitosan membrane development and studies for heavy metal removal;
- heavy metal removal from waste water; and
- determination of volatile organic compounds in waste water.

The electrical power cables, power quality and electrical machines focus area had the following three active projects:

- fluid thermal systems;
- heat and wear resistant composit materials; and
- engineering vibrations.

In 2000, the Technikon SA had 24 active institutional research focus areas functioning in its four academic divisions.

TABLE 37: TECHNIKON SA RESEARCH FOCUS AREAS FOR 2000

Division: Applied Community Sciences	<ul style="list-style-type: none"> <li>• Disaster management, relief and contingency plans</li> <li>• Applied languages and constitutional demand of multilingual and multicultural SA</li> <li>• The management of HIV/AIDS</li> <li>• Governance and the implementation of curriculum 2005</li> <li>• Unemployment and community development</li> <li>• Student retention and throughput</li> <li>• Academic development and access courses</li> </ul>
Division: Applied Natural Sciences and Engineering	<ul style="list-style-type: none"> <li>• Nature conservation</li> <li>• Indigenous knowledge systems</li> <li>• Horticulture</li> <li>• Telecommunication and access services</li> </ul>

	<ul style="list-style-type: none"> <li>• Environment management and sanitation</li> <li>• Science education</li> <li>• Academic development and access courses</li> </ul>
Division: Economic and Management Sciences	<ul style="list-style-type: none"> <li>• Eco-tourism, rural tourism development and management</li> <li>• Entrepreneurship and the development of small and medium enterprises</li> <li>• The financing of small industrialists</li> <li>• Student retention and throughput</li> <li>• Academic development and access courses</li> </ul>
Division: Public Safety and Criminal Justice	<ul style="list-style-type: none"> <li>• The private sector security industry in South Africa</li> <li>• Human rights and criminal justice</li> <li>• Police studies and policing</li> <li>• Student retention and throughput</li> <li>• Academic development and access courses</li> </ul>

Technikon SA also had institute activities in the four academic divisions.

TABLE 38: TECHNIKON SA INSTITUTES IN 2000

Division: Applied Community Sciences	<ul style="list-style-type: none"> <li>• Institute of Public Management</li> <li>• Institute of Applied Communication</li> <li>• Institute of Staff Development</li> </ul>
Division: Applied Natural Sciences and Engineering	<ul style="list-style-type: none"> <li>• Institute of Technology and Entrepreneurship</li> </ul>
Division: Economic and Management Sciences	<ul style="list-style-type: none"> <li>• Institute of Organisational Development and Transformation</li> <li>• Institute Bureau for Business Studies</li> <li>• Bureau for Marketing Research</li> </ul>
Division: Public Safety and Criminal Justice	<ul style="list-style-type: none"> <li>• Institute for Human Rights and Criminal Justice</li> </ul>

In 2002, the institutional focus areas functional at the Vaal Triangle Technikon were:

- environmental pollution and health;
- the integration and application of information and communication technology (ICT) in resource-based education;
- the contextual implications of ICT-facilitating flexible work options in South Africa;
- visual methods in social science research;

- re-engineering teaching and learning: accounting and auditing; and
- practice-based visual research.

The Technikon Northern Gauteng established two focus areas in 2002. The names of the focus areas or of the main activities included in the niche area were not reported and the Annual Research Report also did not mention whether these niche areas were funded by the NRF.

Across the technikon sector, the growth in the establishment of institutional research focus areas indicated a positive response to the CTP vision of establishing research focus areas. However, the nature of the output in terms of the focus areas would indicate the extent to which the focus areas approach contributed to the process of establishing a research culture.

Table 39 summarises the growth experienced in institutional research focus areas.

TABLE 39: INSTITUTIONAL FOCUS AREAS

Year	Number of institutional focus areas
1998	14
1999	28
2000	24
2001	No institutional focus areas reported by the technikons
2002	8
Total	74

An analysis of the development of institutional focus areas in operation, as reported by the technikons in their Annual Research Reports, reveals that the first technikons that managed to focus their institutional research activities were: the Cape Technikon; the Free State Technikon; the Port Elizabeth Technikon; the Technikon SA and the Vaal Triangle Technikon. These technikons, therefore, took the lead in implementing the vision of the CTP as regards establishing a research culture. Initially, all the research activities taking place in the schools and faculties were documented, but, as the years progressed, technikons streamlined this process, including

their coverage of reporting and the process of concentrating research in those areas with the most research potential.

One of the possible reasons for the lack of reporting done on institutional focus areas in 2001 could be that 2001 was the year in which the NRF launched its Focus Area programme. When the funding of research in concentrated areas became a national issue, technikons started to rethink their areas of research focus, with the result that most technikons commenced with a process of re-alignment, as indicated in the next section.

(c) Centres of Excellence

The Eastern Cape Technikon established a Centre of Excellence and Expert Systems in 1998. The Centre was established as part of a collaborative initiative between Telkom SA, the telecommunications industry and the South African Government, launched in 1997 (<http://www.tellabs.com>). The Eastern Cape Technikon centre had three research focus areas, namely telecommunications, rural construction and manufacturing engineering. In 1999, a fourth focus area, computer-aided engineering product development, was added to the activities of the centre. No reporting was done on the centre's activities from 2000 to 2002.

At the Technikon SA, the Telkom Siemens Centre of Excellence, forming part of the above-mentioned collaborative initiative, was launched in June 1999. The aim of extending the already-existing University of the Witwatersrand centre to the Technikon SA was to enable postgraduate students at both institutions to conduct research and development into telecommunications service and access and to find innovative ways of integrating different technologies used in telecommunications ([http://www.cellular.co.za/news\\_1999](http://www.cellular.co.za/news_1999)). The projects active in 2000 included non-linear signal processing techniques for channel characterisation and performance improvement; non-linear techniques for improved channel utilisation; graph matching for improved service provision; and dynamic network reconfiguration and quality of service routing.



At the Border Technikon, a Centre of Excellence in Tourism and Leisure was established in 2001. The purpose of the establishment of the centre was to contribute toward the economic growth and development of both the region and the country as a whole. This centre was the only centre of its kind at the technikon and the criteria set for, as well as the way in which the centre came into existence, could not clearly be determined.

In addition, another Centre of Excellence, the Eastern Cape Centre of Excellence in Water Research, Management and Development, situated in the School of Applied Science, was also approved by the Senate of the Border Technikon in 2003. This centre came into being as a result of a collaborative project between the technikon and the University of Maryland, which had, as its last phase of capacity building, the establishment of Centres of Excellence. Difficulties have been experienced with determining to what extent this centre's activities are research-related. This centre was also the only centre that received Senate approval based on the meeting of the criteria concerned, namely evidence of the presence of well-qualified academic staff with a minimum of 20% with Doctorate or terminal degrees and 50% with Master's Degree or equivalent; an increasing number of postgraduates; a demonstrated extent of staff equity; a demonstrated extent of student equity; wide interactions with labour market and regional and national interactions; interactions with regional, national, continental and overseas institutions; the presence of a five-year strategic plan; a business plan, with at least 30% of its income generated from external sources; staff competency in outcomes-based education and technology; satisfactory student retention and throughput rates; state-of-the-art laboratories; evidence of community and labour market satisfaction; recognition of its leaders by the region; and multi- or transdisciplinary projects.

Technikon Vaal Triangle also established a Telkom Centre of Excellence in 2003 with two focus areas, namely fuel cell technology and voice over Internet Protocol (VoIP). The Centre had, at the time of completion of this thesis, already attracted the following postgraduate projects:

- the design and development of a practical voice over Internet protocol network for a multi-user enterprise;
- the design and development of a zinc-air fuel cell power supply for rural electrification;
- the Design of a unitised regenerative fuel cell for remote telecommunications applications;
- the design and development of a direct methanol fuel cell for telecommunication;
- the design and development of a remote monitoring system for fuel cells;
- the design and development of a voice-activated automation system; and
- application of the zinc-air fuel cell to the fuel cell UPS.

Telkom Centres of Excellence were also functional at the following technikons in 1999 ([http://www.cellular.co.za/news\\_1999](http://www.cellular.co.za/news_1999)):

- the Peninsula Technikon, in collaboration with the University of Stellenbosch;
- the Pretoria Technikon, Technikon Northern Gauteng and Technikon North West;
- the Technikon Witwatersrand, in collaboration with the Rand Afrikaans University; and
- the ML Sultan Technikon, in collaboration with the University of Durban Westville.

In addition to the Telkom Centre of Excellence Programme, the Department of Science and Technology launched a Centre of Excellence Programme in June 2004. So far, six centres, all currently housed by universities, have been established in terms of this programme implemented by the NRF. The programme for such, details of which were outlined in the national Research and Development Strategy accepted by Cabinet in 2002, "...envisioned Centres of Excellence to focus strongly on human resource development and on popularising science. The Centres of Excellence would also promote the establishment of networks of excellence across the African Continent to enhance innovation in line with Science and Technology New Partnership for Africa's Development (NEPAD) and Southern African Development Community (SADC) initiatives" (<http://www.info.gov.za/speeches/2004>).

The above discussion clearly shows that, during the early years of the decade, three notions of the concept 'Centre of Excellence' existed. The first 'type' of Centre of Excellence referred to those centres related to the collaborative initiative between Telkom SA, the telecommunications industry and the South African Government, as launched in 1997 (<http://www.tellabs.com>). The second 'type' of Centre of Excellence referred to those centres established purely within an institutional context, such as those at the Border Technikon.

The third 'type' of Centre of Excellence referred to those that came into existence as part of the Department of Science and Technology's programme launched in 2004. As mentioned, these centres have been, up until now, housed in universities and have had as their focus the development of human resources and the popularising of science in line with the NEPAD and SADC science and technology initiatives.

No other technikon established centres similar to those at the Border Technikon, as all others opted for the adoption of the focus area approach, with the tendency being to steer all activities of the faculties and schools concerned into those areas where sustainable expertise was demonstrated. This development is discussed in the next section.

(d) **NRF Focus Areas**

In 2001, the NRF developed the Technikon Programme, with associated focus area funding. This programme combined the former Institutional Programme for Technikons for research in the natural sciences and engineering with the Technikon Research Development Programme for research in the social sciences and humanities (National Research Foundation, 2001(b):1). According to this programme, the technikons could submit focus areas for funding at either the activity, the unit or the centre level.

The classification of the focus areas in any of these categories was based on the meeting of a number of criteria.

The NRF defined a niche area as an area with a well-defined central research focus, involving a number of disciplines or aspects of a single discipline. The planned niche area would provide the framework for the research activities concerned, either for the individual or the group of researchers involved. The projects were required to be interrelated and the merit of the projects would be assessed within the context of the niche area concerned.

The Witwatersrand Technikon Annual Research Report indicated that the technikon received NRF funding for the following focus areas in 2001:

- evaluation of environmental and occupational mutagens;
- nanomaterial technology;
- minerals processing and technology;
- design, artefactual production and economic development; and
- the technology of cereal, tuber and legume foods.

TABLE 40: NRF FOCUS AREAS FOR 2001

Institution	Number of NRF Focus Areas
Vaal Triangle Technikon	5
Technikon Witwatersrand	5
Total	10

The Vaal Triangle Technikon Annual Research Report indicated that the following focus areas at the technikon received funding in both 2000 and 2001. In 2002 the following two areas were approved by the NRF for niche area funding:

- nutrition for public health in the Vaal Triangle; and
- the application of low-cost power electronics to high-frequency power generation.

The Pretoria Technikon’s Annual Research Report indicated that the Pretoria Technikon submitted 13 niche areas to the NRF in 2001, of which 9 were provisionally approved, with the technikon resubmitting 11 niche area proposals to the NRF in 2002.

TABLE 41: PRETORIA TECHNIKON FOCUS AREAS FOR 2002

Focus Area	Niche area and status
Analytical Separations and Spectroscopy	Analytical Separations and Spectroscopy – approved at centre level
Industrial Control Systems and Communication Technology	Industrial Control Systems – to be resubmitted Telecommunications for Development – approved at unit level
Improving Quality of Life	Food Innovation, Quality and Safety –approved at unit level for 2004 Exercise and Immunology for Healthy Adults – awaiting outcome Biotechnology – to be developed
Decision Support to the Wildlife Industry	Decision Support to the Wildlife Industry – to be resubmitted
Minerals Processing and Utilisation	Polymer Processing – to be resubmitted Cement Technology – approved at unit level
Responsible Tourism	Economic Contribution of Tourism in southern Africa – to be developed Environmental Impact of Tourism in the Savannah region of South Africa – in development Tourism Safety and Security – to be developed Tourism Technology – to be developed
Educational Design and Development	Teaching, Learning and Technology – to be resubmitted
Mathematical Technology	Mathematical Technology Modeling for Industry – approved at unit level
Smallholder and Organic Agriculture	Food, Nutrition and Livelihoods – approved at unit level
Utilising ICT for Development	ICT for Disadvantaged Communities – provisionally approved at Activity level Information Technology – to be developed
Appropriate Architecture for Southern Africa	Society, Space and Sustainability: Reconstructing the Urban Landscape in South Africa – after limited support for 2004, to be resubmitted
Pollution Control and Waste Management	Solid Waste Technology for Sustainable Resource Management and Pollution Prevention – submitted to the NRF Water Use and Waste Management – submitted to the NRF
Sustainable Livelihood and the Eradication of Poverty	Public Management – to be developed
Creative Arts Practice	Art and Design in Community – to be developed
Automotive Component and System Manufacturing	Application of Laser Technology in Component Manufacturing – to be developed Mechatronics Appropriate for the Automotive Industry – to be developed Development and Optimisation of Manufacturing Processes – in development
Entrepreneurship	Technological entrepreneurship – in development

The above table indicates that six focus areas were approved for funding by the NRF in 2002.

The Port Elizabeth Technikon Annual Research Report indicated that the following six focus areas were approved for funding by the NRF in 2002:

- the Innovating batch technology for downstreaming chemical products niche area, the only one of its kind to be approved at centre level anywhere in the country at the time;
- the Business Information integration and security niche area, approved at unit level;
- the Manufacturing Technology niche area, approved at unit level;
- the Forest Engineering and forest fire management niche area, approved at unit level;
- the Utilisation of wildlife in the Eastern Cape, approved at activity level; and
- the Applied Business research centre (automotive cluster), approved at activity level.

The Technikon SA reported that the technikon had developed the following five focus areas for registration for funding in terms of the NRF's Technikon Programme in 2002:

- an investigation into the practical implementation of multilingualism and multiculturalism in the context of co-operative education – a niche area approved for NRF funding in 2002;
- The management of natural, cultural and historical resources for sustainable development in South Africa;
- the challenges facing South African security agencies within the context of globalisations: post-September 11 2001;
- challenges in the delivery of effective teaching and learning via the distance mode; and
- victim empowerment in criminal justice.

According to the NRF Grants Registers for 2001 and 2002, the institutions listed in tables 42 and 43 received focus area grants (National Research Foundation, 2001(c)); 2002(d)).

TABLE 42: NRF FOCUS AREAS FOR 2001

Institution	Number of NRF focus area grants
Durban Institute of Technology	3
Pretoria Technikon	2
Cape Technikon	1
Port Elizabeth Technikon	2
Technikon Free State	2
Peninsula Technikon	1
Technikon Witwatersrand	1
Total grants	12
Total participating technikons	7

TABLE 43: NRF FOCUS AREAS FOR 2002

Institution	Number of NRF focus area grants
Durban Institute of Technology	5
Pretoria Technikon	3
Cape Technikon	2
Port Elizabeth Technikon	3
Technikon Free State	1
Peninsula Technikon	1
Total grants	15
Total participating technikons	6

An analysis of the grants' distribution between the various focus areas for 2001 and 2002 is presented in Table 43.

TABLE 44: FOCUS AREAS FUNDING

Focus area	2001	2002
Challenge of globalisation perspectives from the global South	0	0
Conservation and management of ecosystems and biodiversity	1	2
Distinct South African research opportunities	1	0
Economic growth and international competitiveness	3	5
Education and the challenges for change	0	1
Indigenous knowledge systems	1	2
Information and communications technology and the information society in South Africa	2	2
Socio-political impact of globalisation	0	0
Sustainable livelihoods and the eradication of poverty	2	1
Unlocking the future: advancing and strengthening strategic knowledge	2	2
Total	12	15

The table shows that the focus area economic growth and international competitiveness received the most funding, with 8 grants being awarded for research in this area over the two years in question. Though the comparison of technikon focus area grant holders with university grant holders is a cause for concern, such is not the issue of focus of this section of the discussion. What is more important is that the technikons could not have been successful in utilising the process of focusing research in order to establish a research culture. The low number of grants for focus area research reflects the low capacity of the sector to focus its research, in spite of the growth in the submission and approval of certain focus areas, as reported upon by the technikons in the Annual Research Reports.

(e) The Technology Station Programme

The Tshumisano Trust Technology Station programme was developed by the former Department of Arts, Culture, Science and Technology and the German Agency for Technical Co-operation to "...strengthen and accelerate the interactions between Technikons/Universities of Technology and SMME's" (CTP, 2003). This programme was developed as one of the vehicles by which the technikons' strategy for innovation and technology transfer could be implemented.

The abovementioned strategy was devised by a team of technikon officials in April 2003, with technology stations being established at the following technikons:

- an electronics station at the Technikon Pretoria in 1998;
- a chemical products station at the Technikon North West and the Mangosutho Technikon in 1998;
- a metals value-adding station at the Technikon Free State in 1998;
- a composite materials station at the Vaal Triangle Technikon in 2001;
- a textile testing station at the Peninsula Technikon in 2001; and
- an automotive components station at the Port Elizabeth Technikon in 2001 (Tessmar, 2001).



The Technology Stations Programme consisted of a number of overall goals, with prescribed objectives, purposes and results attached to these goals. Each of the goals has a number of indicators of success. The second purpose, namely that the programme aims to orient technikon graduates and research and development needs towards satisfying the needs of SMMEs, is important. This purpose has a number of results linked to it, of which two are of significance, namely that stations be capacitated as providers and brokers of technology services and that research and development curricula of technikons be refocused on meeting SMME needs and problems (Tessmar, 2001).

The Vaal Triangle Technikon Annual Research Report confirms that the technikon received approval for funding for the establishment of a Technology Station in 2001. During the next year, the funds for the technology station were awarded and released by the Department of Science and Technology, with the name of the technology station being finalised as the Vaal Composites Technology Station.

The technology station was “established to serve industry, students [for] skills and knowledge around the conversion of composites into value-added projects, developing economically feasible processes to manufacture these products...” ([http://www.vut.ac.za/technology\\_station.htm](http://www.vut.ac.za/technology_station.htm)). The technology station would serve as a teaching facility, with students being encouraged, through innovation, to become involved in consultation work for industry. The station would also promote technology transfer to industry and SMMEs, improving the awareness of composite technology in industry and facilitating the design and pilot-testing of the manufacturing processes concerned (Ibid)

The Research Report for the period from 1996 to 2003 reported on the functioning of a Technology Station in Electronics at the Pretoria Technikon, as well as on that of a joint Centre for Polymer Technology managed together with the M&M Tek of the CSIR. In addition, a joint Chair in Technological Entrepreneurship, in collaboration with the University of Twente and the Technikon Northern Gauteng, was established in February 2002.

All other annual research reports of the remaining five technikons omitted any reference to the activities conducted at the technology stations at their respective technikons. Such an omission gives rise to questions regarding the progress of these stations countrywide, as well as about the success of the programme. Once again, it might have been the case that the necessary capacity for sustaining the intended activities was insufficient.

(f) Alternative institutional structures to focus research

Technikon Free State established a so-called 'Science Park' with certain areas of research foci in 1999. The Technikon Annual Research report stated that the Science Park acted as a catalyst in innovation by creating an environment in which partnerships between businesses and the Technikon, as well as amongst businesses, could be formed (Annual Research Report, 1999).

The centre initially consisted of four of what the institution called focus areas, namely the Commercial Centre, the Innovation Centre, the Incubation Centre and the Science Park SMMEs. In 2000, the focus areas were reduced to three, with further refinement of their activities. The Commercial Centre activities included supplementary health services, environmental monitoring, rapid prototyping, manufacturing and testing of mechanical products, electronic design and manufacture, fibrinogen services, aspects of hospitality and tourism and health and environmental research and development.

The Innovation Centre's activities included a wide range of support to new innovators made possible by making modern technology available at reduced costs, leading to the development of new products and processes by these new innovators. A three-phased business plan was implemented, of which Phase One was to establish the park, consisting of internal Centres of Excellence that would be commercially viable.

Phase Two consisted of the establishment of an innovation and incubation programme, as well as that of an office for technology management and the secretariat, while Phase Three referred to the establishment of self-

sustainable SMMEs. The concept of The Science Park seems to have been in line with the nation-wide links envisaged between the SMMEs and the technikons concerned.

### 5.3.3 Concluding remarks

The two factors that formed part of the process of establishing a research culture, namely ongoing master's, doctoral and non-degree projects and the adoption of a focus area approach to research have been discussed. Details of the project activity reveal that most of the M Dip Tech projects (286), current during the period under review, were registered in 1993, with most of the Laureatus projects (6) also being registered in that year. Most of the M Tech projects (45), current during the same period, were registered in 1998, five years after the promulgation of the Technikon Act No. 125 that mandated technikons to offer degrees. Most of the D Tech projects (10), during the time under review, were registered in 1996.

When looking at the distribution of the current projects per qualification, 77 % of the projects current were at the Master's Diploma level, 2% at the Laureatus Diploma level, 18.5% at the Master's Degree level and 2.5% at the Doctorate level. Such figures indicate that the technikons did not embrace degree-based research to the extent that it could contribute to the process of establishing a research culture, especially an applied one.

This presents the technikons with a problem when it comes to using the current projects as a process factor for contributing to the establishment of a research culture, especially when desirous of organising research in certain focus areas. The low number of grants awarded for focus area research conducted at technikons, as indicated earlier, also indicates the low contribution made by the establishment of focus areas as a process factor in establishing a research culture.

Such a finding leads to the questioning of (a) the validity; and (b) the success of the focus area approach to research as a process factor for establishing a research culture, especially when taking the available input factors into consideration.

The establishment of focus areas displays more characteristics of a managerialistic approach to research as regards directing the research concerned to assist the government's initiatives in relation to direct funding in certain areas strategic to the development of the country, than those of a process factor aimed at establishing a research culture.

#### 5.4 OUTPUT FACTORS

Up to now, attention has been paid to the input and process factors available for implementing the strategies and plans of the technikon sector aimed at establishing a research culture. The capacity of technikons was seen as insufficient for the successful establishment of a research culture, as far as regards suitably qualified staff, the number of postgraduate students and funding.

A process of enhancing the amount of participation in research projects in order to stimulate research, and the steering of research into certain predetermined areas of focus, concentrating research strengths, was implemented. Though such a process was reasonably successful, NRF funding for focus area research was relatively insignificant in comparison with the number of focus areas established at the technikons. At the stage of compilation of this study, the contribution of the focus area initiative to establishing a research culture was also unknown. The initiative, instead of being a means to an end, seems to have become the end in itself. By this is meant that, though the sector was very active in establishing quite a number of different types and forms of focus areas, it is still not clear to what extent this initiative was successful as a strategy for establishing a research culture.

The focus of this section is on the figures reflecting technikon research output, which we normally accept as evidence of a research culture. The obvious question is whether the technikons have, in fact, succeeded in increasing their research output over the past 15 years.

In an attempt to measure the success of the strategies and plans implemented to establish a research culture, the output factors of higher

degree graduations and the completion of research projects are discussed. Reference is made to the need for completion of the projects discussed in the previous section, as such completion would serve to indicate the likelihood of sustaining research activities, sound research management and a high level of supervision, which are all necessary elements of a research culture. The production of SAPSE unit-earning outputs and the nature of papers read at conferences by technikon staff are also discussed in this section.

5.4.1 Higher degree graduations

Table 45 summarises the number of master's and doctoral graduation figures, as drawn from the DoE HEMIS database. The table also indicates the percentage increases from one year to the next. A continuous, although small, increase in the number of students graduating with master's qualifications from technikons was noted. The situation was not the same in the case of the Laureatus and D Tech graduations, which tended to fluctuate from one year to the next.

TABLE 45: MASTER'S AND DOCTORAL GRADUATIONS

Year	M Dip Tech and M Tech graduates	% Increase	Laureatus and D Tech graduates	% increase
1998	107		6	
1999	165	35	10	40
2000	207	20	6	-66
2001	229	10	17	65
2002	306	25	24	29
Total	1 014		63	

When the graduation figures are compared with the enrollment figures, a very different scenario emerges, however, despite the time that it took postgraduate students to complete their qualifications not being brought into account. The percentages in the last column, therefore, do not indicate the throughput rate of postgraduate students, but merely present a comparison of the number of students enrolled for postgraduate qualifications and the graduates of a given year, as well as the number of postgraduate students both in, and exiting, the system from 1998 to 2002.

**TABLE 46: M AND D ENROLLMENTS IN RELATION TO M AND D GRADUATES**

Year	Master's and doctoral enrollments	Master's and doctoral graduates	Percentage of graduates
1998	949	113	12
1999	1 269	175	14
2000	1 815	213	12
2001	2 573	246	10
2002	3 362	330	10
Total	9 968	1 077	12

The average of 12% of graduates in terms of master's and doctoral enrollments per year does not indicate a favourable relationship between input and output. Another aspect of the relationship between input and output is the per capita output of master's and doctoral graduates per staff member with postgraduate qualification, as indicated in Table 47.

**TABLE 47: PER CAPITA POSTGRADUATE OUTPUT**

Year	Number of M and D staff	Number of M and D graduates	Per capita output	Number of staff per FTE graduate
1998	646	113	0.17	6
1999	1 077	175	0.16	6
2000	1 029	213	0.21	5
2001	1 125	246	0.22	5
2002	1 221	330	0.27	4
Total	5 098	1 077	0.21	5

The master's and doctoral graduate output per staff member with postgraduate qualification at technikons from 1998 to 2002 is only 0.21. The last column reflects the situation, indicating that, on average, five staff members with a postgraduate qualification contributed to the graduation of one master's and/or doctoral graduate at technikons for the period under review. Such figures once again demonstrate a very unfavourable input-output ratio.

#### 5.4.2 Higher degree project completion

In addition to students graduating with postgraduate qualifications, details of the projects completed from 1984 to 2002 also add meaning to the discussion of the knowledge production output of technikons. The projects listed in Table 48 consist of the projects undertaken for the Master's Diploma in Technology, the Laureatus Diploma, the Master's Degree in Technology and the Doctorate Degree in Technology from 1984 to 1999, as well as the master's and doctoral graduations from 2000 to 2002.

The table indicates details relating to the projects completed from 1984 to 1998, as of 14 December 1999, when the CTP documented the data available on the NAVTEC database, as maintained by the Free State Technikon.

TABLE 48: COMPLETED PROJECTS FROM 1984 TO 2002

Year of Registration	M Dip Tech Projects	Laureatus Projects	M Tech Projects	D Tech Projects	Total Projects
1984	2	0	0	0	2
1985	5	2	0	0	7
1986	4	2	0	0	6
1987	15	4	0	0	19
1988	29	3	0	0	32
1989	19	1	0	0	20
1990	44	0	0	0	44
1991	38	1	0	0	39
1992	36	0	0	0	36
1993	34	1	4	0	39
1994	27	0	2	0	29
1995	18	1	5	0	24
1996	31	0	19	1	51
1997	3	0	15	1	19
1998	94	3	37	5	139
1999	10	0	155	10	175
2000	8	1	199	5	213
2001	6	0	223	17	246
2002	–	–	306	24	330
Total	423	19	965	63	1470

The figures for 1999 to 2001 are those provided for the master's and doctoral graduations, as drawn from the DoE HEMIS database. The figures for 2002, as drawn from the CTP Profiles, neither distinguish

between the master's diploma and the master's degree, nor between the Laureatus and the doctorate degree. The graduation figures were used due to their being regarded as indicating the completion of projects. Comparison of the completed masters diploma projects and the masters degree projects from 1993 to 1998 suggests a noteworthy trend.

TABLE 49: MASTER DIPLOMA AND DEGREE PROJECTS

Year	Master Diploma projects	% Master Diploma projects	M Tech Degree projects	% M Tech Degree projects	Total Projects
1993	34	89	4	11	38
1994	27	93	2	7	29
1995	18	78	5	12	23
1996	31	62	19	38	50
1997	3	17	15	83	18
1998	94	72	37	28	131
Total	207	69	82	30	289

The comparison fails to indicate an overwhelming number of students completing their degree-based postgraduate research projects at the technikons. Only 82 (28%) of the 289 completed projects registered from 1993 to 1998 were degree projects. Based on these figures, the strategy to introduce the postgraduate degree programmes in an effort to establish a research culture, as well as the implementation of a process of involving technikon students in postgraduate degree research in order to provide the country with technologists who could promote the transfer of technology, was unsuccessful. The figures concerned indicate that technikon students steered away from degree-based projects for a substantial number of years after the introduction of the degree qualification structure. A comparison of the graduation figures from 1999 to 2002 shows a substantial increase in the completion of M Tech Degree projects. When dividing the total of 964 graduates among the four years from 1999 to 2002, we see that an average of 241 projects were completed each year, whereas the technikon students concerned only managed to complete 301 projects, the equivalent of an average of 50 projects per year, from 1993 to 1998. An analysis of the projects from 1984 to 1998 shows that most projects were engineering-related.



TABLE 50: COMPLETED PROJECTS IN THE CESM CATEGORIES

CESM CATEGORY	NUMBER OF PROJECTS
1 Agricultural and Renewable Natural Resources	4
2 Architecture and Environmental Design	0
3 Arts, Visual and Performing	12
4 Business, Commerce and Management Sciences	37
5 Communication	2
6 Computer Sciences and Data Processing	13
7 Education	21
8 Engineering and Engineering Technology	269
9 Health Care and Health Sciences	93
10 Home Economics	9
11 Industrial Arts, Trades and Technology	3
15 Life Sciences and Physical Sciences	41
17 Military Sciences	0
19 Physical Education, Health Education and Leisure	0
21 Public Administration and Social Services	0
Total	504

#### 5.4.3 SAPSE unit-earning outputs

In addition to the number of higher-degree graduates and the completion rate of postgraduate research projects, the number of SAPSE units earned by technikons served most probably as the most reliable, and hence important, indicator of research output, given that such figures are both standardised and audited. Universities and technikons earn SAPSE units by submitting research outputs in the form of published journal articles and conference proceedings, books and/or chapters in books, patents and artefacts, as well as technical and research reports, to the DoE.

Table 51 and 52 indicate the number of units that technikons earned from 1998 to 2003 and also serves to demonstrate the tremendous diversity of the sector, ranging from the earning of 256.39 units by the Pretoria Technikon to the earning of only 1.27 units by the Eastern Cape Technikon over the seven years in question. The average number of units per technikon for the said period was 72 units.

TABLE 51: INSTITUTIONAL DISTRIBUTION OF UNITS EARNED

Technikons	1998	1999	2000	2001	2002	2003	Total
Border	0.00	0.4	3	1.00	5.00	6.80	16.2
Cape	17.18	12.00	10.62	12.61	11.00	20.41	83.82
Eastern Cape	0.23	0.00	0.04	1.00	0.00	0.00	1.27
Free State	14.68	11.00	12.62	8.49	20.00	21.37	88.16
Mangosuthu	0.00	1.00	0.00	1.00	1.00	5.95	8.95
ML Sultan	5.06	7.00	5.59	17.40	12.00	–	47.05
Natal	17.90	20.30	26.35	20.12	14.00	–	98.67
DIT	–	–	–	–	–	26.65	26.65
N Gauteng	3.00	3.00	3.00	6.00	1.00	4.20	20.20
N West	2.00	2.30	2.00	1.00	5.00	8.20	20.5
Peninsula	8.65	9.00	5.50	7.30	4.00	12.40	46.85
P Elizabeth	17.99	30.00	18.53	21.54	30.00	32.22	150.28
Pretoria	17.06	22.00	47.01	40.65	70.00	59.67	256.39
TSA	10.55	14.00	9.33	0.00	24.00	11.40	69.28
V Triangle	3.00	6.00	10.78	8.94	16.00	4.88	49.60
Witwatersrand	15.17	36.00	9.14	7.40	13.00	15.70	96.41
Total	132.47	174.00	163.51	154.45	226.00	229.85	1 080.28

TABLE 52: SAPSE UNITS AWARDED TO TECHNIKONS

Technikons	Total
Pretoria	239.33
DIT	172.37
Port Elizabeth	150.28
Witwatersrand	96.41
Free State	88.16
Cape	83.82
TSA	69.28
Vaal Triangle	49.60
Peninsula	46.85
North West	20.50
Northern Gauteng	20.20
Border	6.4
Mangosuthu	5.95
Eastern Cape	1.27
	<b>1 067.48</b>

Table 53 shows the growth in the number of SAPSE units from 1998 and 2003. The 1998 figures were used as a starting point and the total as the end-point. The number of 1998 units was subtracted from the total in order to indicate the growth from where technikons were in 1998 to where they were in 2003. The growth in the number of units, as well as the percentage growth based on the above calculation, are indicated in the table.

TABLE 53: INSTITUTIONAL GROWTH IN UNITS FROM 1998 TO 2003

Technikons	1998	Total	Growth in units	Percentage growth
Border	0.00	6.4	6.4	100
Cape	17.18	83.82	66.64	80
Eastern Cape	0.23	1.27	1.04	82
Free State	14.68	88.16	73.48	83
Mangosuthu	0.00	5.95	5.95	100
ML Sultan	5.06			
Natal	17.90			
DIT	–	172.37	149.41	87
N Gauteng	3.00	20.20	17.20	85
N West	2.00	20.50	18.50	90
Peninsula	8.65	46.85	38.20	82
P Elizabeth	17.99	150.28	132.29	88
Pretoria	17.06	256.39	239.33	93
TSA	10.55	69.28	58.73	85
V Triangle	3.00	49.60	46.60	94
Witwatersrand	15.17	96.41	81.24	84
	132.47	1 067.48	935.01	88

The growth in research output on an institutional basis, as can be seen in a comparison of 1998 data with the totals, has been phenomenal. The table shows that the following technikons were the main contributors in this regard: the Pretoria Technikon; the Durban Institute of Technology (resulting from the merger of the Natal Technikon and the ML Sultan Technikon); the Port Elizabeth Technikon; the Witwatersrand Technikon; the Free State Technikon and the Cape Technikon.

Table 54 illustrates the per capita SAPSE unit output per technikon for the period 1998 to 2002.

TABLE 54: PER CAPITA SAPSE UNIT OUTPUT PER TECHNIKON

Technikons	1998	1999	2000	2001	2002	Total
Border	0.00	0.03	0.02	0.00	0.03	0.08
Cape	0.06	0.40	0.03	0.04	0.03	0.56
Eastern Cape	0.00	0.00	0.00	0.00	0.00	0.0
Free State	0.10	0.06	0.07	0.06	0.14	0.43
Mangosuthu	0.00	0.00	0.00	0.00	0.00	0.0
ML Sultan	0.02	0.03	0.02	0.07	0.04	0.18
Natal	0.05	0.05	0.08	0.06	0.04	0.28
DIT	–	–	–	–	–	–
N Gauteng	0.01	0.01	0.01	0.03	0.00	0.06
N West	0.02	0.03	0.02	0.01	0.05	0.13
Peninsula	0.05	0.04	0.03	0.04	0.02	0.18
P Elizabeth	0.07	0.12	0.07	0.08	0.12	0.46
Pretoria	0.04	0.05	0.10	0.08	0.13	0.4
TSA	0.04	0.05	0.04	0.00	0.13	0.26
V Triangle	0.01	0.02	0.13	0.03	0.05	0.24
Witwatersrand	0.04	0.09	0.02	0.02	0.03	0.2
Total	0.28	0.41	0.42	0.29	0.53	1.93

#### 5.4.4 Papers read at conferences

Table 55 lists the number of conference papers read by technikon staff at national and international conferences from 1999 to 2002, as reported by the research directors in their respective annual research reports. The figures provided indicate a decrease in the number of papers read for two of the three years under discussion. The annual average number of papers read during the four years under review was 290.

TABLE 55: PAPERS READ BY STAFF FROM 1999 TO 2002

Year	Percentage increase/decrease	Number of papers read
1999		284
2000	–30.29%	198
2001	+44.06%	354
2002	–8.19%	325
Total		1 161

Cross-tabulating the number of papers among the staff with postgraduate qualifications presents an interesting correlation of input with output.

TABLE 56: CORRELATION BETWEEN STAFF AND PAPERS READ

Year	Staff with post-graduate qualifications	Number of papers read	Percentage of staff reading papers
1999	1 077	284	26
2000	1 029	198	19
2001	1 125	354	32
2002	1 221	325	27
Total	4 452	1 161	26

Over the 4 years, 1 161 papers were read by the 4 452 staff members in possession of postgraduate qualifications at the time. These figures show, on average, a participation of 26% of the staff members concerned in conferences. Dividing the number of papers by the number of staff reveals an average of 3.8 papers per staff member for the four-year period under review. Table 57 depicts the number of papers read per technikon staff member for the period 1999 to 2002.

TABLE 57: PAPERS READ PER CAPITA

Year	Number of teaching staff	Number of papers read per staff member
1999	3 395	0.08
2000	3 546	0.06
2001	3 424	0.10
2002	3 758	0.09
Total	14 123	0.08

#### 5.4.5 Concluding remarks

The discussion in Section 5.4 aimed to provide a quantitative profile of the factors impacting on the research output at technikons as evidence of the presence of a research culture. The following four output factors were discussed: postgraduate degree graduations; the completion of degree-based research projects; the number of SAPSE units earned by technikons; and the number of conference papers read by technikon staff.

The discussion showed a steady increase in master's and doctoral graduates, though still only a very small percentage of students enrolled for post-graduate qualifications. The input-output ratio of this aspect of technikon research should therefore still be addressed.

This situation should provide a parallel with the completion rate of higher degrees research projects, which also showed an increase over the years under discussion, but, what was nevertheless still alarming, though, was the smaller output of degree-based projects in comparison with diploma-based projects. This should serve as a clear indicator of the tremendous challenge that technikons were to face in this area.

Especially in contrast with the student research culture, staff can be seen to have been outstandingly productive when it comes to research. The SAPSE units earned by the respective institutions showed a dramatic increase, although starting from a very low point, and the number of papers read at conferences has also increased substantially. Such an improvement could indicate that the process of establishing research focus areas has contributed to the enhanced level of activity undertaken at technikons. An analysis of the actual outputs that resulted in the earning of the units concerned would, however, be the better indicator of this cause–effect relationship.

5.5 CONCLUSION

In order to summarise the final conclusions based on the figures presented in this chapter, a quantitative comparison of the input figures with those of process and output, as the intention was stated initially, should prove useful. Table 58 provides a summary of the figures provided in the systems framework and shows the relationship between input, process and output.

TABLE 58: SUMMARY OF INPUT, PROCESS AND OUTPUT

INPUT		PROCESS		OUTPUT	
M and D Staff	31%	Current projects	10 026	Completed projects	506
M and D students	1% of total 35% of NHD/B Tech	Focus areas	74 Institutional 55 FRD Activity 27 NRF Grants	M and D Graduates	1 077
M and D Scholarships	R3 985 000			SAPSE units	1 080.28
Bursaries	R8 468 512			Conference papers	1 161
NRF Grants	R140 335 133				

In future, UoTs would have to improve the process, so that more research projects would be completed and more students would graduate from the system. More students would have to be encouraged to continue their studies at postgraduate level, and more would have to be done to the infrastructure to create an environment conducive to research. The universities could, for instance, consider the establishment of postgraduate support groups. They would also have to make larger financial contributions to supporting student research and would have to decrease their dependence on state funding.

For this purpose, the universities, in the future, might have to establish postgraduate alumni systems that would willingly contribute to the making of substantial financial commitments towards the enhancement of postgraduate studies. At the time of completion of this thesis, It was still too early to measure the contribution made by the process of focusing research on the completion of student projects and graduations, but, in order for the focus area approach to be successful, it was noted that student post-graduate enrollments would have to be directed towards the focus areas approved at the respective universities. As already mentioned, the process of focusing research might in itself have been successful, as well as providing a measure for the direction of public research funding. However, the extent to which the focus area approach contributed to the establishment of a research culture was still not clear.

Figure 8 indicates the quantitative data reflecting the values of each of the factors discussed in the chapter.

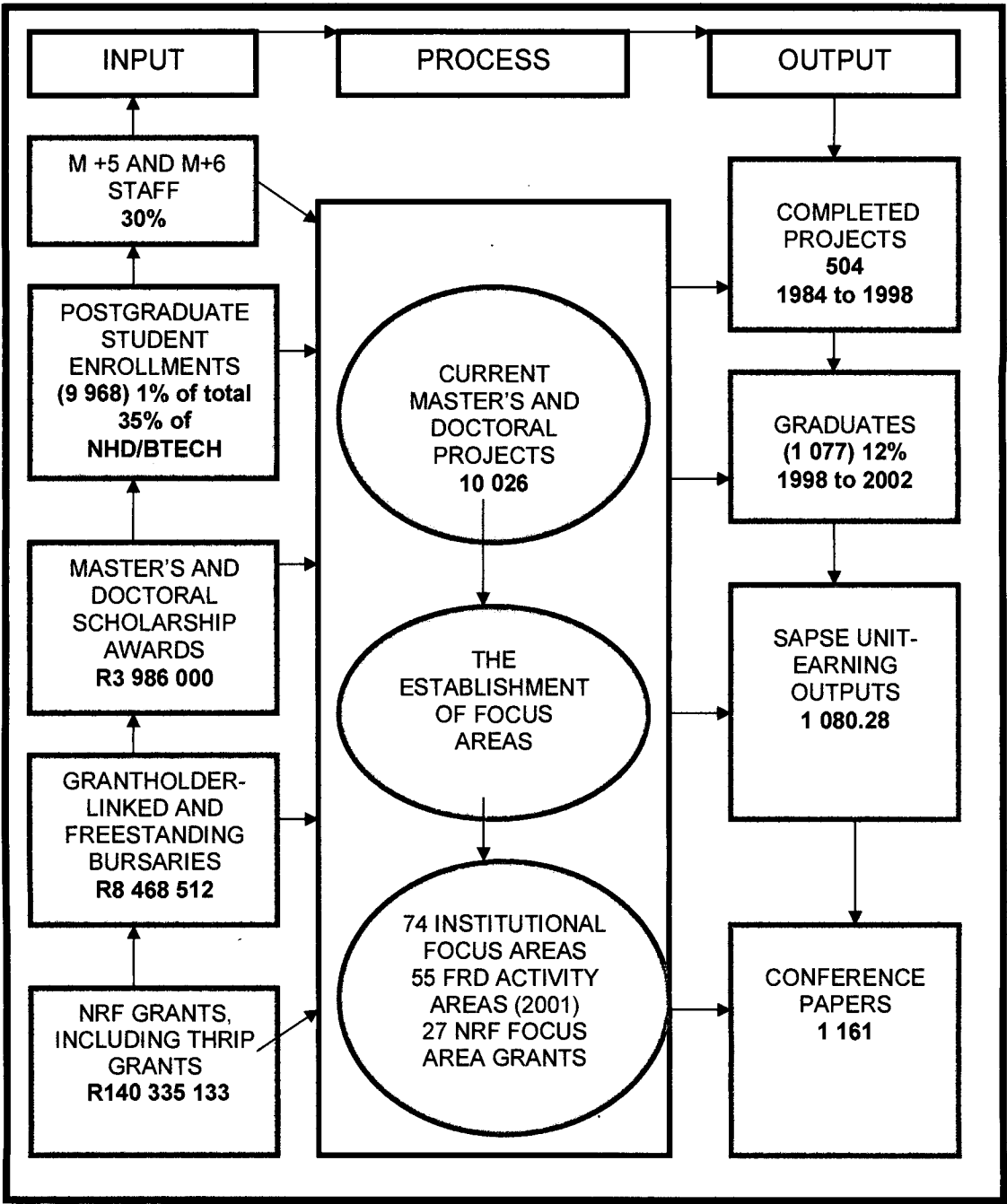


FIGURE 8: SYSTEMS FRAMEWORK INDICATING INPUT, PROCESS AND OUTPUT



## **CHAPTER SIX**

# **CONCLUDING REFLECTIONS ON RESEARCH AT TECHNIKONS: THE JOURNEY FROM APPRENTICESHIP TRAINING TO TECHNOLOGICAL DEGREES**

## CHAPTER SIX

### CONCLUDING REFLECTIONS ON RESEARCH AT TECHNIKONS: THE JOURNEY FROM APPRENTICESHIP TRAINING TO TECHNOLOGICAL DEGREES

	PAGE
6.1 INTRODUCTION	270
6.2 THE EVOLVING TECHNICAL EDUCATION MISSION	271
6.2.1 The proliferation and institutionalisation of diversity in the provision of technical education	271
6.2.2 The continuing problematic process of differentiation between vocational and technical education	275
6.2.3 The development of the provision of formal centrally-controlled technical higher education	278
6.2.4 The differences of opinion between the Department of Education and the sector officials regarding the nature of technical higher qualifications	281
6.2.5 The inclusion of research in the technical education mission	284
6.3 THE TRANSLATION OF THE VISION INTO STRATEGIES AND PLANS FOR ESTABLISHING A RESEARCH CULTURE	286
6.3.1 The vision of research at technikons	287
6.3.2 The gap between the vision, strategies, plans and performance	290
(a) The gap between the advancement of the qualification structure and the output of technologists	
(b) The gap between the adoption of the applied research orientation and the output of technologists	
(c) The gap between the advancement of the qualification structure and staff development.	
(d) The gap between the managerial focus area approach and research output	
6.4 IN CONCLUSION	300

## CHAPTER SIX

### CONCLUDING REFLECTIONS ON RESEARCH AT TECHNIKONS: THE JOURNEY FROM APPRENTICESHIP TRAINING TO TECHNOLOGICAL DEGREES

#### 6.1 INTRODUCTION

Research performs many functions within the technikon sector. Amongst these, research has been a major driver in the technikons' journey from apprenticeship training to technological degrees, the concomitant redesignation processes and the technikons' survival as Universities of Technology in the restructured South African higher education system. It is along this journey that I wish to base the conclusions of my study.

I present my conclusions in two parts. Part One presents the first major conclusion that research developments at technikons evolved in a pattern so closely resembling and reflecting an evolving technical education mission that it is difficult if not impossible, to pinpoint cause and effect. There are five factors that make it difficult to separate cause from effect, namely the:

- diversity entrenched in the provision of technical education;
- continuing problematic differentiation process between vocational and technical education;
- development of the provision of formal centrally-controlled technical higher education;
- differences of opinion between the Department of Education and the sector officials on the nature of higher qualifications; and the
- inclusion of research into the technical education mission.

Part Two of the discussion contains the second major conclusion of this thesis, namely that a gap has developed between the technikon officials' vision for a research culture at technikons, the translation of this vision into strategies and plans to establish a research culture and the actual establishment of a research culture.

An evaluation of technikon research output in terms of the nature, scope, content and volume of research reflects a limited understanding of the relation between the input factors and the process factors utilised to lead to a system capable of sustaining a research culture.

In Chapter Four I indicated that technikon officials were successful in ensuring the continuation of the majority of the former fifteen technikons in the new higher education landscape. Although not successful in transforming the teaching culture into a research culture, they were at least successful in transforming the technical education mission. The Universities of Technology have entered their next phase of development - a phase during which the institutions can build on the foundation of the research culture of applied and technological research laid by the technikons.

## 6.2 THE EVOLVING TECHNICAL EDUCATION MISSION

### 6.2.1 The proliferation and institutionalisation of diversity in the provision of technical education

Diversity in the provision of technical education was from the outset entrenched and remained an integral element of a system initially consisting of the co-existence of diverse technical education institutions and eventually of diverse technikons. Diversity in, for example, the institutional mission was ever-present and evolved in nature. I discussed how diversity contributed to the challenge of differentiating between vocational and technical education and the establishment of a formal centrally-controlled technical higher education system. The technikon sector developed amidst and was taking with it into the future a host of diverse aspects such as differences in origin, institutional vision and mission, capacity and resources, status and institutional type. These differences would eventually lead to a very diverse research landscape.

In Chapter Two I also discussed the numerous attempts and number of ways in which the differences were addressed from one period to another. Eventually, diversity became one of the key attributes and formed the basis for restructuring the South African higher education system into a differentiated yet unified South African higher education system.

Essentially the recommendations of the National Working Group centred on increasing the basis for diversity and differentiation in higher education. Detailed reference was also made to the role of the CHE as one of the first bodies to propose a model for the new diverse and differentiated restructured higher education landscape and how this opened debates on the future size and shape of South African higher education. As the process of restructuring continues, the concept of diversity underwent some changes. For example, the restructuring included the 'process of differentiation' as it focused on steering mechanisms, horizontal differentiation, inter-institutional collaboration and new forms of higher education institutions. The National Plan referred to a 'new diversity' versus the 'old diversity' and it became acknowledged that a 'new diversity' was establishing itself in terms of the higher education landscape.

A strange twofold challenge faced the role-players participating in the process of re-engineering the South African higher education landscape. The first was the entrenched diversity present in the provision of technical higher education and the second was how to 'use' this diversity to establish a single, unified, differentiated centrally-controlled higher education system. The re-engineering of the higher education landscape led to the establishment of a technical education institutional 'type', namely the University of Technology, signaling the arrival of ten of the fifteen remaining technikons at a new destination in the evolution of the technical education mission.

As previously mentioned, the diverse nature of the sectors goes back to the early years of technical education in South Africa when the first technical institutes were established in 1828. Up until 1867 technical education was provided by a system of co-existence of mechanics institutes which were mostly established between 1828 and 1867, and apprenticeship classes, which started between 1884 and 1904. Both these educational forms were driven by the colonial governments and were established to meet the demand for technical education created by the industries in the particular colonies.

Already at that stage the colonial and provincial education departments felt a need to formalise the provision of technical education. To satisfy this need, trades schools, industrial schools, technical institutes and technical colleges were established. However, in spite of the intentions that the education departments may have had, this initiative only exacerbated the co-existence of the mechanics institutes with the apprenticeship system. This inevitably led to an technical education landscape characterised by a diversity of institutional types. The interactions between the colonial and provincial government railways and the government education department at this stage was an early demonstration of the emergence of tension between demand-led and supply-led technical education.

The manner in which the different trades schools and technical institutes were established led to very different entrance requirements between the Cape and the Transvaal Trades Schools as well as between the various colonial and provisional technical institutes. In terms of the scope of provision, the Cape Colony, as early as 1895 offered technical education in the form of a more formal structure, namely by means of a scheme of two years 'preliminary' education to be completed at the South African College.

From an early stage, legislative processes also contributed to the diversity that developed in the provision of technical education in South Africa because they led to the declaration of some technical education providers as higher education institutions. This led to a system of diversity of institutional type, as well as diversity of status. The technical education system at the time consisted of technical institutes and technical colleges of which some were higher education institutions and others not. This meant that some institutes and some colleges offered secondary education and others not, because the colleges and institutes that were declared higher education institutions had to stop all 'high school work' which meant the closing down of the high school divisions.

The diversity of status of institutions remained a characteristic of technical education provision.

In the Cape Province technical colleges were established in East London and Port Elizabeth in 1925, and in the same year, the Witwatersrand Technical Institute was declared a higher education institution. In 1926 a technical college was established in Pietermaritzburg and in 1931 a technical college was established in Bloemfontein. The ML Sultan and Peninsula Technical Colleges were established in the 1920s to provide entrance into technical education for Indians and Coloureds. The establishment of these two technical colleges added yet another, but very different, characteristic to the already complex base of diversity, namely ethnic diversity. This diversity of race would eventually be legalised by the apartheid government from 1948 onwards.

From 1948 to 1978, the separation of the fourth year of the sandwich course to form the basis for the addition of the National Higher Diploma added to the diversity in terms of entrance requirements. The Education Department approved the addition of the National Higher Diploma in 1963 as well as the entrance of the holders of the four-year sandwich course into this diploma.

The redesignation of the four largest technical colleges as Colleges for Advanced Technical Education with the promulgation of the Advanced Technical Education Act No. 40 in 1967 further differentiated institutional type. The Cape, Natal, Pretoria and Witwatersrand Colleges now formed a different type of institution, namely Colleges for Advanced Technical Education. Soon after the promulgation of the Act, the Port Elizabeth and Vaal Triangle technical colleges also joined the group and, in 1969, the ML Sultan Technical College was redesignated as a CATE and, in 1972, the Peninsula Technical College became the Peninsula CATE. These developments demonstrate how legislation institutionalised the diversity in the technical education system.

The technical education landscape now consisted of technical institutes, technical colleges and Colleges for Advanced Technical Education.

It is from this point onwards that the awareness of the relationship between the CATEs and the universities, which was briefly raised for the first time in 1940 and then again in 1956, gained momentum.

#### 6.2.2 The continuing problematic process of differentiation between vocational and technical education

The differentiation between vocational and technical education was a process that continuously presented problems contributing to the complexities found in the evolving technical education mission.

This was firstly the case because the differentiation process contributed to the diversity discussed earlier, and secondly because it steered the developments towards a need for formal centrally-controlled technical higher education. The differentiation process also contributed to the differences of opinion between the technical education officials and the Department of Education.

One factor that contributed to the problematic process of differentiating between vocational and technical education during these years was the absence of clear definitions for technical and vocational education. Up till then officials had defined neither the types education nor the training so that the difference was clear. The difficulties inherent in this situation seemed to have arisen from the fact that technical education at the time was provided to meet the needs of vocations developing exclusively from the technical field.

To a certain extent this explains why the government education department officials reverted to the consideration of contextual factors to assist them in the differentiation process, rather than the consideration of content factors, as one would assume would have been more appropriate from an educational and labour point of view.

By contextual factors I refer to features such as the level at which technical education should be offered and entrance requirements thereto, in other words the environmental or external factors surrounding the development



of technical education. The content factors, in contrast, are those features that would distinguish vocational education from technical education, referring to the true nature of each type of education, namely the internal factors. This action of the education department signaled the emergence of the desire of the Education Department to address governance and systemic order, two contextual features that would eventually be central to the restructuring of South African higher education.

Other than the different age and level at which technical education should be entered, the uncertainty about the level at which technical education should be offered also contributed to the continuing problems in differentiating between vocational and technical education. Such problems of differentiation led to the resolution at the conference on technical education in January 1902 that there was a need for vocational education at a higher level. As a result, technical institutes were established to provide technical education to apprentices at a level higher than the secondary level.

The process of distinguishing more clearly between vocational and technical education gained momentum after the establishment of the Union in 1910. The flaws that Professor Snape observed in the apprenticeship system contributed to this momentum. The importance of Professor Snape's work lay in his definition of technical education, in terms of which the shortcomings of the level at which knowledge was imparted at the apprenticeship training level, was exposed.

Professor Snape also distinguished between technical education and apprenticeship training by classifying technical education as full-time technical instruction and apprenticeship training as instruction supplementary to the practice of a certain trade. For the first time vocational and technical education, as two distinct types of education could be differentiated from each other.

In spite of the very clear definition provided by Professor Snape, we note that preferential consideration to contextual factors mostly remained the

practice between 1924 and 1947. The Van der Horst Commission, appointed in 1926, not only reported on the potential capacity of technical colleges to offer science education, but also promoted such colleges as the ideal providers of technical education.

The Commission also determined that the technical education offered by the technical colleges should be provided at the secondary level. In terms of the differentiation between vocational and technical education, the van der Horst Committee recommended to the Minister of Education that vocational education should not commence before the age of fourteen. At the same time, they recommended that all post-Std 8 work should be offered at technical colleges. The Minister of Education accepted both these recommendations.

Problems associated with the differentiation process were therefore not only caused by the absence of clear definitions of vocational and technical education. The process of deciding which type of education should be the domain of which type of institution extended the process well beyond the differentiation between technical and vocational education. The decision-making process also led to the awareness of an apparent overlap between the functions of the various types of institutions in the technical education landscape, which, in turn, led to the need to differentiate between technical and science education. To address this issue the Department of Education appointed the Eybers Committee in 1940 to look into the issue of the overlapping of functions between the technical colleges and universities.

In 1945 the Minister of Education appointed the De Villiers Commission to investigate the scope of technical and vocational education and the types of institution most suitable to the offering of these types of instruction. The De Villiers Commission also found that there was a serious overlap in the functions of the different types of institutions. After a lengthy debate on the recommendations made by the De Villiers Commission, the commercial and technical high school divisions of technical colleges were granted permission to offer education at the Std 9 and 10 levels, as had been recommended by the Van der Horst Commission in 1926.

This development again demonstrates how the preferential consideration of context factors led the differentiation process. From then on, vocational education would be positioned at the secondary level and technical education at the tertiary level.

One of the outcomes of the work done by the De Villiers Commission was the introduction of the technician's diploma course in 1956. The course, consisting of three years theoretical education and one year practical training, was developed to address the gap existing in the structure between the occupations of the artisan and the engineer, and later became known as the 'sandwich course'. This course was the first real evidence of advanced technical education.

For the first time a content factor was considered in differentiating vocational education from technical education. In addition, it prompted a response to two contextual factors: the level at which the course would be offered as well as the entrance requirements to such course. These factors were addressed by the Vocational Education Act, in 1956.

This course made a significant contribution to the differentiation of technical education from vocational education, as it allowed the holders of the technician's diploma entry into the newly developed National Higher Diploma, from 1963 onwards.

### 6.2.3 The development of the provision of formal centrally-controlled technical higher education

The development of a formal centrally-controlled technical higher education system became a central feature of the evolving technical education mission. The factors previously discussed, namely diversity and the problematic nature of the process of differentiating between vocational and technical education, are shown to contribute to the establishment of a formal centrally-controlled system.

The first attempts of the desire to formalise technical education and to establish a system of central control were evidenced as early as 1895,

when the first Trades School was opened in Uitenhage. The Education Department aimed to replace the informal uncoordinated apprenticeship system with government-coordinated trades training. Even though the Trades Schools were established to formalise the provision of technical education, the informal provision of technical education continued in the shape of provincial apprenticeship developments into the early 1900s.

The conference on technical education held by the Education Department in 1902 was the first organised effort to put a formal centrally-controlled technical higher education system in place. This conference led to the establishment of technical schools in terms of higher education.

The provision of formal and structured technical education gained momentum with the establishment of technical institutes in 1903. At the time each province had its own model of apprenticeship training with a variety of types and levels of support being provided by the provincial governments. The establishment of the technical institutes, therefore, stimulated the need to formalise technical education as well as to finance these types of educational institutions. The South Africa Act of 1909 eventually addressed the financing of vocational and technical education.

In 1911 the Minister of Education organised the second conference on Technical, Industrial and Commercial Education and an important resolution decided on at the conference was that vocational education should be centrally controlled. The advisory board, appointed in 1912 to centralise the control of technical education was not successful in centralising technical education and the Union government took control of all educational sectors that the provinces could not manage, which included the education provided by the universities and technical colleges of which the latter, by 1915, included the Cape Technical College and the Natal Technical College.

The outcome of Professor Snape's investigation into the status of technical education, as well as the disparity in the grants system and the need for state control of education, contributed to the establishment of the Union

Department of Education in 1919. The need for state control was further driven by the inability of the provinces to finance the expanding system of vocational education, which led to the promulgation of the Higher Education Act No. 30 in 1923.

The consideration of central control also featured in the investigation undertaken by the Van der Horst Commission, appointed in 1926. It was the view of the Commission, appointed by the Education Department, that the control of technical education was divided between the provinces and the Union simply because of the manner in which technical education was financed.

The outcome of the Commission's investigation was a recommendation that the technical colleges become 'schools' that offered a specialised (technical) education.

The next Commission to make a contribution to the provision of formal centrally-controlled technical higher education was the De Villiers Commission. Upon completion of the work of the Commission in 1949, a National Council for Education and a new national system of education was established under the Department of Education. The resolution that the commercial and technical high school divisions of technical colleges could offer education at the Std 9 and 10 levels made no contribution towards solving the problem of divided control of secondary vocational education, because the colleges protested against the recommendation made by the De Villiers Commission to transfer the control of the technical and commercial high school divisions to the Department of Education for control.

However, in 1954, after consultation between the Union government and the Department of Education in 1954, the Fact-Finding Committee recommended that the Cabinet take over the technical colleges as full state institutions.

#### 6.2.4 The differences of opinion between the Department of Education and the sector officials regarding the nature of technical higher qualifications

The differences of opinion between the Department of Education and the sector officials regarding the nature of technical higher qualifications formed an integral element of the evolving technical education mission. Various committees were, over time, established by the Departments of Labour and Education, in a combined effort, together with the individual technical education officials, to solve the technical education problems and to provide direction.

The first attempt to address the organisation of technical education and the relationship between the colonies and the central government departments came in the form of the promulgation of the South Africa Act, in 1909. The Act limited the transfer of any provincial education, offered at a level lower than the higher education level, from provincial to central control. This stipulation was made in the absence of a clear definition of higher education. The promulgation of the Act led to the continued provincial control of technical education, with attention being given to the financial relations between the Union and provincial governments.

Tension was caused by the promulgation of the Financial Relations Act No. 5 of 1922, the Higher Education Act No. 30 of 1923 and the Apprenticeship Act No. 26 of 1922. The Financial Relations Act defined higher education as being provided by, amongst other, technical colleges, which were thereby declared places of higher education. The Higher Education Act provided for the inclusion of the technical colleges into higher education, seeing that the provinces were unable, at that stage, to finance vocational education.

At the same time the Apprenticeship Act authorised the technical colleges to offer the theoretical component of apprenticeship training. However, the Act only applied to the technical colleges not under state control, which meant those not funded by the state.

By means of the establishment of the Association of Technical Colleges, in 1926, the technical college officials organised themselves to promote the role that the colleges should and could play in the provision of technical education in South Africa at the time.

One of the earliest signs of difference of opinion between the technical education officials and the government in the provision of technical education emerged in 1927 when the Natal Technical College stated a desire to offer technology degrees in Durban. Both the Natal Technical College, as well as the Cape Technical College, had already, by this stage, been declared higher education institutions in terms of the Higher Education Act of 1923.

The Education Department's view was that the offering of degrees was the prerogative of the University College in Pietermaritzburg. The attempts of the Natal Technical College to offer technology degrees therefore led to the perception that the technical college had university pretensions, whereas the 1920's Parliament was adamant that no more university colleges would be established in South Africa. The Natal Technical College was instructed to develop a range of technological and commercial programmes.

This was the first sign of the Education Department's position that technological and academic education should be provided by two types of institutions at two different levels.

As part of the events leading to the final decision of the Minister of Education made in 1927, the Department of Education appointed the Van der Horst Commission in 1926 to look into the issue of the overlapping of functions between the university colleges and the technical colleges. The unhappiness of the technical college with the views expressed by the Commission was not the only bone of contention. The Van der Horst Commission was also dissatisfied with the Union Government's position regarding the technical colleges. The Commission felt that the Union government, in wanting to establish a system of formal centrally-controlled education, simply had taken over the control of one of the branches of

secondary education and designated it 'higher education'. At the same time, the colleges felt the Commission had taken the easy way out by 'downgrading' the colleges by allowing them only to offer specialised (technical) secondary education.

The Association of Technical Colleges believed the Commission was misled by the amount of elementary work done by the colleges. The presence of the large amount of elementary work done at technical colleges was a result of the stipulation in the Apprenticeship Act that the colleges had to take responsibility for the theoretical component of apprenticeship training and because many of the apprentices had to start their studies at an elementary level.

The above description is an example of the tensions created by the legislative developments, almost 'steering' developments of the institutions in a certain direction, whereas the natural developments of the institutions indicated a different direction, mostly based, up until such a time, on the demands of industry. This is an important point, because the number of role-players in the provision of technical education kept growing and diversifying, each adding their own point of view to the agenda of the debate regarding the evolving technical education mission.

In addition to the difficulties addressed by the Van der Horst Commission and the De Villiers Commission, respectively appointed by the Department of Education in 1926 and 1945, the Vocational Education Act No. 29, promulgated in 1947, contributed to the tension between the Government and the technical education sector officials. The tension grew when the National Party replaced the United Party in heading the government in 1948. It was the United Party government that, in 1945, appointed the De Villiers Commission, whose report was released in 1949 under the recently instated reign of the National Party. The colleges strongly rejected the De Villiers Commission proposal that the high school divisions of the technical colleges be placed under the control of the Department of Education.



At this point, the Department of Labour appointed its own committee to study the De Villiers Commission's report, which led to the promulgation of the Apprenticeship Amendment Act No. 28 of 1951, of which the main intention was to improve the apprenticeship system.

Five years elapsed between the promulgation of the Vocational Education Act No. 29 of 1946 and the Apprenticeship Amendment Act No. 28 of 1951, as well as between the latter and the Vocational Education Act No. 26 of 1956. Such delays demonstrate how the labour and educational legislative processes interacted with each other in shaping the technical education mission.

#### 6.2.5 The inclusion of research into the technical education mission

The above discussion paid attention to the earliest prominent factors that impacted on the evolving technical education mission. Attention is now focused on the inclusion of research in the technical education mission and how this process led to difficulties in pinpointing the relationship between cause and effect.

Reconstructing the history of the technikon sector in South Africa does not immediately provide an answer to the question as to whether the college officials 'used' research to strengthen their efforts to advance technical education to assure the CATEs a place in higher education, or whether the introduction of higher qualifications as part of advancing technical education necessitated the consequent engagement in research.

The question arises as to whether research was used as an 'instrument' in the 'battle' to achieve legitimacy or whether the focus on research emerged naturally as the sector 'matured' over time. The answer might be more complicated than it first appears, consisting of more than merely having to establish the relationship of cause and effect. Rather, one could argue that the recognition and acceptance of the essential role of research in this sector evolved alongside a growing maturity and clarification of the identity of technikon institutions.

What is certain is that the sector experienced the pressures caused by entrenched diversity, the problematic process of differentiation between vocational and technical education and the desire of the government to formalise and centralise the control of the provision of technical higher education. The sector had no choice but to engage with the role of research in their endeavour to transform the mission of technical education.

The advancement of technical education formed a central part of the technical education agenda in the early 1960s, leading to consensus between the government and college officials. However, for the latter the process of advancing technical education, which occurred increasingly during the late 1970s and more so during the 1980s, entailed the inclusion of research as part of the said agenda.

In the CTP's view, the introduction of research would:

- enhance the image of the technical education institutions;
- broaden the scope of education offered by the CATEs to enable the country to obtain a ready supply of much-needed technologists;
- restore the balance between applied and basic research; and
- develop the staff involved in this sector of education.

There were, however continuous differences of opinion between the Department of Education and the college officials regarding the nature of higher qualifications offered initially by the CATEs, as well as regarding the role of the technikons, especially in terms of the role, function and place of research in such qualifications.

As has already been seen, it was the preferential consideration of contextual (formal) factors over content (substantive) factors that created the momentum in the development of the technical education mission. One could similarly argue that the views of the Department of Education represented the contextual (formal) position, while the views of the college officials represented the content (substantive) position.

Such a deduction is not, in itself, surprising, because government has the function of creating the necessary educational context and regulatory environment for education providers, whereas the technical education officials advocated the cause that technical education institutions should provide the type of education deemed necessary by the country.

### 6.3 THE TRANSLATION OF THE VISION INTO STRATEGIES AND PLANS FOR ESTABLISHING A RESEARCH CULTURE

The various contributory factors discussed so far, as well as, even more so, the continuing differences between the government and college officials contributed to the gaps that developed between the vision held by the college officials of research at technikons, the strategies and plans implemented to establish a research culture and the research performance of technikons between 1998 and 2002.

The Department of Education approved the addition of the National Higher Diploma to the qualification framework in 1963. At approximately the same time the government appointed the Mönning Advisory Commission to advise the government on the organisation of science in the country. In the report, published by the Commission in 1964, recommendations were made regarding the advancement of the status of the four largest technical colleges in the country at the time to that of technological colleges.

Such a change in status did not take place, but the deliberations on the report of the Commission led to the promulgation of the Advanced Technical Education Act in 1967 and, amongst others, the redesignation of the Pretoria, Johannesburg, Durban and Cape Town Colleges as CATEs.

One of the outcomes of the Advanced Technical Education Act was a resolution by the DoE that CATE students would not be able to obtain advanced technical qualifications by means of research. However, the DoE, had already, in 1963, approved the addition of a fourth year to the qualification structure of the CATEs. This development, together with the promulgation of the Advanced Technical Education Act, paved the way for the colleges to add research to their educational function.

### 6.3.1 The vision of research at technikons

One of the outcomes of the work done by the Goode Commission was the recognition of the value of research for the enhancement of the education and training function of the CATES.

Essentially, the Commission determined the need to train engineering technologists, which led to the development of the fifth-year Masters Diploma in Technology and, later still, to the sixth-year Laureatus Diploma in Technology.

As a result of this finding of the Goode Commission, the Department of Education in 1977 accepted the concept of a qualification building from a three-year diploma into a five-year diploma in technology,. At the time, the demand for higher qualifications offered at the CATEs grew, leading to an understanding of the important role that research would play in the future.

The year 1979 was a significant one for technical education in South Africa, due to the uniquely South African redesignation of the four largest CATEs as technikons. The two CATEs providing technical education to the Indian and Coloured population groups, namely the ML Sultan CATE and the Peninsula CATE, were also shortly thereafter redesignated as technikons. The provision for the non-white population groups of technikons, which later became known as the historically disadvantaged technikons of South Africa and the former homelands, extended the awareness of the presence of ethnic diversity in the realm of South African higher education.

The presence of the 19 education departments at the time when the ethnically designated technikons were established throughout South Africa and in the so-called 'homelands' contributed to a situation calling for the central control of education in South Africa. The aforesaid education departments consisted of an umbrella department, which set the overall norms and standards, under which resided five white, one Asian, one Coloured and eleven African education departments.

By the early nineties, this situation had clearly become unacceptable in a South Africa that was beginning to experience dramatic political changes that heralded a new democratic dispensation. In Chapter Three of my thesis, an exposition of the processes implemented to restructure South African higher education is expounded, as well as the impact that such processes have had on the technikons over the past decade.

In addition to the ethnic differentiation, the relationship between the technikons and universities within the same higher education system became increasingly problematic. This became increasingly evident when the technikons introduced their masters and doctoral degree programmes in 1995. The addition of these two qualifications to the qualification structure led to renewed attention being paid to the importance of establishing a research culture. The technikon officials, to a certain degree, had no choice but to translate their vision of research at technikons into strategies and plans aimed at establishing a research culture for the entire sector.

The demand for the technikons to offer higher qualifications so grew that the DoE eventually had no option but to accept that technikons had a research role to perform. The Department of Education accepted applied research as the orientation of research at technikons and the value of research for the enhancement of the education and training function became an accepted notion during the 1980s.

During the same decade the importance of research was emphasised as a supporter of the technikon teaching function. In 1988, the Department of Education, in its policy document, NATED 02-118, expressed its understanding of the role that research should play at technikons, namely that research would be an essential means by which the technikons could establish and maintain a relationship with industry, facilitating the development of both their lecturing staff and their students.

The Committee of Technikon Principals declared its stance in its first research philosophy document for technikon education, published in 1989.

The CTP referred to the contribution that research at technikons would make to improving the industrial productivity of South Africa, its economic competitiveness and its enhanced ability to enter the export market by way of the development of innovative and creative product development and problem-solving skills applied in an industrial setting by technologists.

The CTP had the vision that the presence of research in the technikon curriculum would ensure a supply of graduates, who would be able to design and produce new products by means of innovative processes, and evaluate and adapt services, systems, materials and appliances for use in manufacturing or the enhancement of industrial performance. In this way, South Africa would come to rely less on imports and would also be able to enhance the quality of its exports. Such independence was especially important during the 1980s, when South Africa was subjected to boycotts due to its apartheid policies. The technikon officials were of the view that technikons, because of their strong orientation towards applied research, were in an ideal position to meet the industrial need for quick problem-solving.

Research at technikons was, in essence, to be goal-oriented and could, therefore, also contribute significantly to the development of the professions for which technikons were educating students. So far, this function of technikon research had been largely underexploited by the technikons.

Many technikon officials also thought that research at technikons would address the imbalance between basic and applied research. The conclusion was drawn that technologists, who had graduated from technikons where they had been skilled in problem identification and solving, would, by filling the gap between basic and applied research, contribute significantly to the research and development future of South Africa. Such forward planning would be especially effective in industry, presenting technikons with suitable sites for the application of research results.

During the 1990s, the view was also maintained that technikons would be in a position to support industries with top-quality advice and services, because of their orientation towards applied research.

### 6.3.2 The gap between the vision, strategies, plans and performance

My study highlights two important dimensions of the introduction of research in the technikon sector: the provision of technologists and the development of staff. Essentially the technikon officials attempted to give substance to their ideals and views to establish a research culture at technikons by implementing two strategies.

- The first was the advancement of the qualification structure, including initially the Masters and Laureatus Diplomas and eventually the Masters and Doctorate Degrees. The aim of this strategy was two-fold, namely to develop staff and to provide the South African labour market with technologists. The technikon officials hoped to achieve this by adopting an applied research orientation at the post-graduate level.
- The second strategy was the approach to manage research and the resulting focus area approach to provide momentum to the establishment of a research culture. My discussion in terms of these strategies is mainly based on the concluding frameworks provided in Chapters Four and Five.

#### (a) The gap between the advancement of the qualification structure and the output of technologists

To discuss the gap between the advancement of the qualification structure and the technikons' output of technologists or postgraduate student graduations, an analysis was undertaken of the current and completed research projects at the Masters Diploma and the Laureatus Diploma level, from 1984 to 1999, as well as of the Masters Diploma in Technology, the Laureatus Diploma in Technology and the Doctorate in Technology graduations that occurred from 1999 to 2002.

The purpose of this analysis was to determine how many technologists the technikons provided for employment in the South African labour market, as well as the relation of such output to the number of full-time staff. At the same time, the analysis aimed at drawing conclusions regarding the institutional distribution of the technologists provided, as well as the concentration of the technologists among the various educational fields, in terms of the CESM categories.

The analysis showed that the technikons provided the South African labour market with only 488 technologists between 1984 and 1999. Over a period of 14 years, the technikons therefore provided the labour market with only 35 new technologists per annum. Of these, 463 were Masters diploma and degree graduates and 25 were Laureatus and Doctorate graduates.

A total of 1 023 technologists' registered projects failed to be completed during the same period. In addition, a very low number of students in relation to the total number of full-time equivalent students progressed from the diploma level to the Masters in Technology Degree and the Doctorate in Technology Degree level during the years 1999 to 2002. The slow progression of such students also contributed to the relatively low Masters and Doctoral graduation rates during these years.

Having said this, there was an increase in the provision of technologists in the period 1999 to 2002, which constitutes an overall increase of 43,6% in the overall provision of technologists over this period. Broken down by the year, the overall figure still only translated into an annual provision of 226 technologists, which remained a low output in relation to the importance attached to research, especially when taking the pace of South African industrial growth into consideration.

Such statistics show a very low output of technologists who could contribute to the innovation and development of South African industries. Further analyses of the data shows that, on average, only 18 students enrolled on average for each Masters of Technology programme per annum throughout the entire sector.



The above discussion shows the gap between the positive intentions of the strategy and the reality. The transformation of the qualification structure of the technikons, therefore, did not have the intended impact on the labour market.

- (b) The gap between the adoption of the applied research orientation and the output of technologists

Technikons adopted and implemented an applied research orientation as a strategy to support their drive to provide the country with technologists. The acceptance of applied research, however, relates strongly to the prominent presence of the binary higher education system in South Africa. In seeking credibility as providers of a unique type of higher education and in attempting to distinguish themselves from the universities and technical colleges, technikons accepted applied research as their main focus.

The very early commitment to applied research by technikons in 1979 can be regarded as so premature that it resulted in a number of problems with which the technikon sector had later to deal. One such problem was the perception that technikons would confine themselves to applied research. This contributed to the a situation in which applied research was seen to be the domain of technikons, while basic research was seen to be that of universities. Such a perception was problematic because it, amongst others, led to a lower publication rate of applied research articles in the recognised DoE-subsidised research journals. From 1984 onwards, though technikons started actively to engage in applied research, they could not develop sufficient research capacity to enable the researchers to publish. This led to a situation in which technikon researchers could not develop their ability to theorise and thereby enhance their capacity to disseminate technological knowledge.

However, acceptance of the applied research orientation was at the same time useful to the technikon officials, because it differentiated the technological degree from other types of degrees, as the notion of applied research was inherently able to be transformed into technological research.

This distinction was used by technikon officials to motivate for the establishment of Universities of Technology.

Seemingly, the inclusion of applied research in the technikon curriculum at the postgraduate level during the 1980s and 1990s was driven by the demands of industry, rather than arising as a result of the successful achievement of the aim of technikon officials to advance the qualification structure. Technikons felt compelled to add research to their activities because they were still regarded as inferior to the universities. The reference to the technikons' role to educate the 'thinker within technology' gains its significance from the fact that technical colleges had traditionally been associated exclusively with the training of technicians, who were mostly practitioners and not 'technologists' as such. This was clearly another attempt by the sector to distinguish itself from the technical colleges. The advancement of the qualification structure to include the training of technologists therefore became important in view of the fact that it would be the technologists who would enable technikons to promote technology transfer.

The role and function of technikon research in technology transfer slowly underwent a further transformation during the 1980s and 1990s, which will now be discussed. Essentially, the view during the 1980s was that technikon research provided a useful mechanism for technology transfer. During the 1990s, the process of reconceptualising technology transfer continued, eventually leading to the development of the idea that technikon research should focus on technology transfer.

The technikons went through a process of redefining the following concepts during the 1980s and 1990s:

- the practice and promotion of technology;
- technology development;
- technology transfer; and the
- role of research at technikons in technology transfer.

The applied nature of research at technikons essentially refers to the potential of technikon research results to be applied to a particular, previously-identified problem or development process. The research undertaken at technikons should therefore, by virtue of this characteristic, be relevant, because it should be driven by the current demand for research. Such a demand is created by a given situation in the South African communities and industries. The research undertaken at technikons is, therefore, also mostly context-specific and, especially in terms of a developing South Africa, strategic in nature.

The applied nature of technikon education, technology transfer and the potential of technikon results to be commercialised were not the main reasons why the CTP steered the technikons in the direction of applied research. Rather, they took this position because they were determined to legitimise the undertaking of a certain type of research by the sector. They also used the undertaking of such research as an instrument to distinguish technikons from universities and to support their ultimate drive to establish Universities of Technology.

The CTP conception of the technikon degree clearly assumed a specific role and function in regards to the type of research undertaken at technikons. As mentioned earlier, opinions differed about the technikon higher qualifications and the role of research in such qualifications. For the technikon officials, the introduction of degrees, especially the technological postgraduate masters and doctorates at technikons, was not only a strategy aimed at making the qualification structure more attractive to prospective students, but also an attempt to create more confidence in technikon education by attaching a higher value to an advanced technical education and applied research than such education had had in the past. As is evident from the discussion in the previous paragraph, the attempts failed, because (1) the system did not attract high numbers of post-graduate enrollments; and (2) the number of technologists that the system produced could not meaningfully contribute to the technological development of South Africa.

One reason for this phenomenon was that technikons at that stage had only recently embarked on developing their staff research capacity and a very small number of students enrolled for and graduated from the higher diplomas. Whether there was the required human capital to establish such a research culture is therefore questionable.

The CTP itself was also not always consistent when debating such issues. On the one hand, the CTP wanted to introduce research at technikons in order to build staff research capacity, but, on the other, they referred to the availability of highly technologically-oriented human resources at technikons. In effect, the latter did, in fact, imply the presence of staff who were skilled technology researchers. The lack of well-qualified staff was clearly evident, as the CTP, on several different occasions, referred to the need to improve the qualifications of the current staff complement.

Previous studies suggested that research aimed at advancing technical education assumed greater importance at the technikons during the 1980s and 1990s. The CTP and DoE both agreed that such a development was the reason for adding research to the range of activities performed by the technikons. The addition of research meant that students could graduate from technikons with research-based advanced qualifications and enter the South African labour market at the level of technologists.

A comparison of the research profile enables one to draw the conclusion that either the technikons were not succeeding in training technologists through their adopted strategy of advancing the qualification structure, or the provision of technologists was not the actual aim driving the strategies and plans implemented in order to establish a research culture.

A number of factors contributed to the above-mentioned state of affairs. The fact that technikons were not successful in their endeavour to contribute to South African industrial development by providing technologists could have resulted from a number of systemic problems.

Amongst such problems could have been:

- the staff research capacity was inadequate;

- students could not meet the research demands of higher qualifications; or
- the technikon degree was not as popular as a university degree.

These reasons invite further study. If one considers that the provision of technologists was not really what the technikon officials intended to achieve with the establishment of a research culture, the officials had to have other aims.

During the 1990s, research became important for the promotion of the technikons' role in technology transfer, in that it established the distinction between the education of technicians and that of technologists. In this respect, the two highest qualifications, the Masters Diploma in Technology and the Laureatus Diploma in Technology, contributed significantly to the raising of research standards. The presence of research, conducted in pursuit of the two highest qualifications, was envisaged as contributing to the provision of the concept of the 'thinker within technology', who would be capable of identifying, as well as solving, industrial problems. Technikons would, therefore, by means of the inclusion of research into the curricula, educate students in industry-based problem-solving (i.e. applied) research methodologies, while the technologists would be those responsible for the promotion of the technology transfer role of the technikons.

The major problem, however, lay in the inability to create a qualification structure conducive to an environment in which research could be superimposed on the existing qualification structure. Such a structure could have facilitated the effective introduction of applied research at the Masters of Technology Degree level. To expect students to receive instruction in research methodology, as well as to complete a research project, however small, in a period of one year expected a great deal from technikon students, especially when seen against the backdrop of the lack of research orientation in undergraduate tuition.

- (c) The gap between the advancement of the qualification structure and staff development

Throughout the study the aim of technikon officials has been seen to lie in the introduction of research and the establishment of a research culture as a staff development strategy. Seemingly, the technikon officials hoped that the advancement of the qualification structure would capacitate their staff to do applied research. However, other than stating their aim to do so, neither the technikon officials nor the DoE ever explained exactly what such advancement entailed.

Statistical evidence should show whether the introduction of research at technikons for purposes of staff development indeed did result in academic staff members studying further through the technikon higher degree structure. Although the number of technikon staff with postgraduate qualifications did increase from 646 in 1998 to 1 221 in 2002, when subjected to analysis, the increase in staff with university masters qualifications in relation to the number of staff with technikon masters qualifications from 1998 to 2002 reveals a very different picture, showing that 2 640 staff members completed university masters degrees, compared to the 152 who completed technikon masters degrees. Such figures indicate that only 5,75% of all staff actually completed their technikon masters degrees.

The scenario in terms of doctoral qualifications is similar, with the data reflecting that 801 staff members completed university doctoral degrees, while 40 staff members completed technikon doctoral degrees, meaning that only 5% of all staff completed their technikon doctoral qualifications. These statistics were a clear forewarning of the lack of success that the technikons would experience in providing the country with a ready supply of technologists. A university degree still clearly continued to be more highly valued than a 'comparable' technikon degree.

The advancement of the qualification structure was therefore not a successful strategy for developing staff if it meant that the advancement of

the qualification structure would encourage staff to improve their qualifications via the post-graduate qualifications offered at technikons.

The second implicit supposition that the statistics do not support is the supposition that the technikon officials aimed at introducing research at technikons to enhance the capacity of technikon staff both to do and supervise applied research. The statistics do not support such a supposition because too few technikon officials experienced the technikon research development process themselves. When comparing the 192 staff who would have been in a position to supervise applied research with the number of postgraduate student enrolments, it becomes clear that the number involved with applied research would not grow and the production of a sufficient supply of technologists would not succeed. In addition, although the increase in the number of DoE units earned for research output steadily increased from 132,47 units in 1998 to 229,85 units in 2003, the majority of the papers and other material published indicate that these studies were not of an applied research nature.

There was also a steady increase in the number of papers read, with an average of 290 papers being read per year from 1999 to 2002. However, when seen in the context of the total number of technikon staff with postgraduate qualifications, whether obtained from a university or technikon, who were capable of participating in conferences, the overall figure reflects a very low per capita conference participation.

- (d) The gap between the managerial focus area approach and research output

The development of a centrally-controlled higher education system had a number of 'by-products' of which the steering of research into certain focus areas was one. The process of steering research at technikons into certain focus areas, however, would not be unproblematic.

I would argue that steering research into certain focus areas was premature, given the overall state and capacity of research in the sector. Instead of focusing their strategies and plans on a process of increasing the volume and scope of research in the applied fields with a concomitant

matching of input factors available to do so, the technikons were overtaken by the research focus area initiative. The importance of having to participate in this drive steered the technikons officials' strategies and plans towards a managerial approach aimed at increasing the effectiveness of the research being undertaken at technikons.

The taking of such a direction led to a gap in the systemic approach adopted by the technikons, which was not so much between the input and output, but between the input and process. The process of steering research into focus areas was not the most effective approach for the resources that technikons had available, given their aim to develop staff and produce technologists in sufficient numbers so as to be able to impact on South Africa's technological development. In other words, the technikon officials used the wrong methods for what they wanted to achieve. The conclusion to be drawn is that there was an alternative agenda to that of the development of staff and the production of technologists.

The statistics support the drawing of such a conclusion. Although there were 55 NRF-approved activity areas in 2001, these areas only developed into 12 NRF focus area grants in 2001 and 15 in 2002. Clearly the required capacity was lacking from the sector that might otherwise have enabled the full utilisation and exploitation of the focus area approach to establishing a research culture.

New government policies and funding frameworks, indicating a focused approach to funding, were developed during the mid to late 1990s. The CTP realised the importance of strengthening technikon participation in the new higher education landscape, as well as the competitive position of such institutions, and therefore encouraged them to concentrate their research activities in certain identified focus areas, based on their links with industry.

To their credit, the initial restriction of research to endeavours aimed at stimulating industries and product development was broadened to include a social dimension in regards to economic growth.



In terms of the CTP vision, the technikons would be able to apply and disseminate their research results by serving as consultants to their immediate industrial communities. By so doing, the links that they would establish with their immediate industrial communities would create research opportunities, as well as enhance the technikons' capacity to access industry funding.

The CTP's position that research at technikons should be relevant to the economic and social development and reconstruction needs of South Africa is a clear indication of the acknowledgement by the CTP of the need to steer research at technikons towards a more focused approach. The purpose of making the transformation objectives explicit was not only to transform the teaching culture, but also to transform the sector to align itself with the new South Africa, the emerging new higher education landscape and the envisaged image of the 'new' technikons. The 'research-steering' philosophy was echoed and reinforced by a similar philosophy adopted by the NRF in 2001.

The requirement of a research vision and mission, managerial commitment and ownership of the research function, the provision of research and development structures, the conduct of a SWOT analysis to position the institution in terms of research, as well as the suggestion that technikons should draw up a business plan for to give greater direction to the research focus areas, are all evidence of the much more managerialist and corporatist approach advocated by the CTP, which again points to the impact of globalisation forces on higher education.

Such a finding also strengthens my conclusions that the CTP was making changes to the qualification structure which led to the introduction of research, predominantly as part of the preparations for the technikons to gain a competitive position in the new higher education landscape. The intention of the CTP to introduce research to provide the South African labour market with technologists and to develop staff was therefore not its primary intention.

Instead, the CTP supported the introduction of advanced and higher qualifications to ensure a place for technikons in higher education. Technikons, now that they had successfully transformed into Universities of Technology, would have to refocus their attention on implementing an appropriate process aimed at establishing a research culture.

#### 6.4 IN CONCLUSION

The study of the establishment of technikons and the direction taken by the sector in terms of the research development have led to the conclusion that the sector adopted an unbalanced systemic approach in establishing a research culture. Technikon officials experienced a paradigm shift in terms of the technical education mission, which contributed to the movement of the technical education mission along the demand–supply continuum. The paradigm shift of the technikon officials was not synchronised with the availability of input factors at technikons, which led to the implementation of processes unsuited to the establishment of a research culture at technikons.

Limited input factors posed a challenge for the establishment of a research culture. The shortage of suitably qualified and experienced researchers, insufficient funding and the other factors previously discussed constrained the implementation of plans and strategies aimed at establishing a research culture. Though the input capacity was, indeed limited, the problem was not confined only to input factors per se. The process itself had its own problems, and, resultantly, the scope, volume, nature and content of research that have, in the course of this study, been identified as indicators of a research culture show that a strong and robust research culture had not yet been established at technikons by the beginning of the current millennium.

The strategy of simultaneously introducing post-graduate degree qualifications, and expecting students to enroll for post-graduate programmes, assuming they had the ability to conduct research projects, as well as expecting staff to have sufficient capacity to support their own,

as well as their students', research development, reflects an essentially unrealistic approach to the establishment of a research culture.

The imbalance was created by the mismatch of the input factors with the resultant processes and deliverables. The small number of post-graduate students graduating from the system after completion of their projects is the result of the way in which the input factors and processes were combined. Technikons may have been more successful if they had adopted a phased approach to the establishment of a research culture. Too many new plans, strategies and processes were adopted and implemented in too short a space of time. The statistics clearly indicated that the staff, for one, though not sufficiently capacitated to support student research development, were, nevertheless, expected to teach and supervise projects at the postgraduate level.

The establishment of a research culture would have been much more successful if a proper system with timeframes geared towards a sequenced implementation of the various processes had been developed.

Other than the above, there are other factors that should not be underestimated in terms of the unsuccessful establishment of a research culture, especially an applied research culture. The first is the fact that Department of Education, in the early days of conceptualising research to be conducted at the Colleges for Advanced Technical Educations, was adamant that technical research was essentially not meant for publication. The second is the fact that technikon research output had to be measured in the only existing system for measuring output, namely SAPSE units awarded for work published in accredited journals, essentially developed for research produced at universities. This, together with the process deficiencies, contributed to the shift in the paradigm of the technikon principals and the natural drift in the type of research conducted by technikon staff as a result of less technikon staff enrolling for technikon degrees than university degrees.

The above discussion highlights the significant shift in the paradigm of technikon officials from that of technikons being the first choice providers of vocational education to one of recognition of the need to embark on a process of transforming technikons into universities. The technikon officials refocused their attention that had, in the past, been directed towards the strengthening of the technikons as providers of technical and vocational education in response to demands from industry to the type of institution that technikons should become within the new higher education landscape.

The technikons, preoccupied with transforming their status and function as role-players in higher education, had sold out their potentially strong relationship to the labour needs and skills development drives of South Africa as a whole. Technikons had once been ideally situated to become the first choice of the government as a skills development partner. However, with the approach that the technikons adopted, steering their focus towards the restructuring of the higher education system, the sector lost sight of the role that it could play in addressing the skills gaps developing in South Africa, especially in terms of the technical occupations. The view that it had become necessary to offer technology degrees became an institutionalised value, which led to the perception that the competitive position of the institutions in terms of research had to be enhanced. It therefore became accepted that participation in the national approach to focus research was necessary, in the light of the assumption that such participation would add momentum to the establishment of a research culture.

The above discussion demonstrates an important ever-present underlying current in the development of technical education in South Africa – the movement of technical education mission along the demand–supply continuum. Initially, for a protracted period, technical education responded to industry demands. The technical education institutions provided the education and training needed by industry to enhance the ability of human resources to provide the necessary technical support to the growing industrial and commercial needs of South Africa.

The industrial sector was, in such terms, the dominant role-player in the making of curriculum-related decisions.

However, with the evolution of the technical education mission, which was more and more inclusive of research, technical education strongly leaned to the supply side of the demand–supply continuum. Such a tendency led to the technical education sector deviating in purpose from how it had originally been conceptualised, as well as to the emergence of new curriculum decision-makers, deciding what will be on offer via the curriculum.

Such an evolutionary process is not innately wrong. However, the process resulted in a pressing need for technically trained personnel, which the South African government had determined should be satisfied by the former technical colleges, which, by this stage, had been transformed into further education and training colleges. The dire need for technical expertise in South Africa had become a stark reality in South Africa. The gap that was created between the demand and supply of technical expertise came as a result of the technikons progressing to the next level of provision as well as the further education and training sector not moving into the gap fast enough.

Had the technikons affirmed their strength in the field of technology-directed education, they would have been in an ideal position to retain their position in the status quo. However, the higher education restructuring process led to the redesignation of technikons as technological universities and one has to understand that this evolution in the technical education mission symbolises something more than what it appears to be, namely a fundamental search for an educational model to serve the needs of a South Africa in transformation. The Universities of Technology may have come into existence because of the impact of internal developments in the sector such as the introduction of research, to position the institutions in the new higher education system, but these movements formed part of the transformation of the education model.

I addressed the difficulty surrounding the conceptualisation processes of vocational, technical, advanced technical and technological education from one period to another, in Chapter Two as well as the greater transformation of the educational system, in Chapter Three and noted that new meanings were attached to the same concepts as the technical education mission evolved.

For instance the concept, vocational education, was at one point used to describe secondary technical training provided by the Trades Schools and technical institutes, but the same concept was used later in the technikon dispensation to describe the type of education the sector provided at tertiary level.

With the redesignation, the technological universities assumed the position of equal providers of higher education (at least in principle), with research becoming a compulsory component of the learning programmes. The real implication, however, for the Universities of Technology lies in the enhancement of industry-based research. Post-graduate technikon students will have to be trained in problem-solving research, because it was the technological learning orientation of the Universities of Technology that will distinguish them from the traditional and comprehensive universities.

Research became important at technikons as a means by which to advance technical education in such a way as to strengthen their demands to be accepted as institutions within the higher education echelon. The rationale, therefore, for accepting research as part of the technical education agenda was not supported by the existence of intrinsic values, such as the desire to establish a research culture for the sake of its stakeholders, but rather by the imposition of extrinsic values, such as those associated with promoting the image of the sector.

The addition of post-graduate qualifications, rather than research itself, assumed greater importance. The technikons, however, understood that the offering of post-graduate degrees meant not only the inclusion of

research in their curricula, but also the development of the capacity to undertake research by both students and staff.

The sustainability of the Universities of Technology into the future therefore depends largely on the ability of the universities to nurture their existing applied research capacity, as well as to identify and stimulate their potential research capacity. For this purpose, the Universities of Technology must take it upon themselves to restore the faith of the South African population in the importance of technological higher degrees by increasing the number of staff enrolling for postgraduate studies.

Two factors, however, have given rise to concern in terms of the technical education mission as it developed over the years have to be highlighted. The first is the complexity of the task involved in measuring the impact of the transformation of an entire sector on its potential to provide the South African labour market with technical human resources in the critical and scarce skills areas identified by its own government. The second is the potential of the sector to meet the demands of the research culture to sustain the Universities of Technology as a provider group.

Therefore, whether there was any logic in the progression or any explainable systemic relationship between the concepts describing technical education developments and the types of institutions following each other in the development of technical education, whether the same issues were addressed over and over, whether there was a drift from technikon-type education to university-type education, whether the dichotomy the technikons created between basic and applied research was real, or whether the introduction of research was driven by strategic rather than pedagogic objectives, are not the most important issues. What has essentially happened is that these developments contributed to the finality that has been reached on the South African education model that would provide the technical expertise needed by the country.

Universities of Technology are given the opportunity to unlock the potential of technological education and applied research, leaving technical,

vocational and occupational education and training to the further education and training band. A likely implication of the establishment of this model is that the further education and training band learners coming from the high schools, are likely to further their studies at the traditional universities and the learners moving into the vocational further education and training band likely to articulate to the Universities of Technology. This will leave the comprehensive universities with a somewhat lesser-defined identity, eventually becoming more of either of the types, possibly taking the education model back to the binary system that the higher education restructuring process attempted at eradicating.

This creates the question on how successful the higher education restructuring was. In addition, the review of the National Qualifications Framework has been completed and contains the three bands of education formerly in the system, namely general education and training, further education and training and higher education, but another aspect, however, has been factored into the model. Together with the bands, three distinct streams of education and training, namely academic, vocational and lastly occupational, have been put in place which is reminiscent of the former trinary education model.

However, although this might be the case as well as the fact that the former technikon post-graduate qualification designations have been deleted from the higher educational qualifications framework, the fact that both the vocational as well as the occupational stream now provides the possibility of qualifications to be generated and registered on levels 5 to 10 of the qualifications framework opens up new possibilities of post-graduate vocational and occupational degrees with unique nomenclatures and on this the Universities of Technology should capitalise.



## REFERENCES CONSULTED

Advanced Technical Education Act, No. 40 of 1967. National Library: Cape Town.

Apprenticeship Act, No. 26 of 1922. National Library: Cape Town.

Asmal, K. 2002a. The Restructuring of the Higher Education System in South Africa. <http://education.pwv.gov.za/what'snew.htm>. [on-line] [accessed: 31/01/02]

Asmal, K. 2002b. The Transformation and Reconstruction of the Higher Education System. Press statement by the Minister of Education, Professor Kader Asmal. 30 May 2002. Pretoria.

Asmal, K. 2002c. The Transformation and Reconstruction of the Higher Education System. Press statement by the Minister of Education, Professor Kader Asmal. 9 December 2002. Pretoria.

Balintulo, M. 2001. Annual Report of Committee of Technikon Principals. 2000.

Bester, F. 1988. The Role of the Technikon in Technology transfer. Dissertation/Thesis. Technikon Witwatersrand: Johannesburg.

Beukes, J.H. 1984. Die technikonwese in die RSA: 'n Verwysingsraamwerk vir navorsingsbeplanning. Report MN-104. HSRC: Pretoria.

Beukes, J.H., Human, A., Marx, C.A. 1990. Ondersoek na die beeld van teknikons: konsepverslag: Publisher not indicated. Bloemfontein.

Betz, H.J. 1984. Annual Report of the Association of Technikons. 1983. Association of Technikons: Port Elizabeth.

Blankley, W. 1997. *Research funding and priorities: the new paradigm*. Conference paper presented at Bifsa, Midrand, 16-17 September 1997.

Border Technikon Review. 1997. Border Technikon: East London.

Border Technikon Review. 1998. Border Technikon: East London.

Border Technikon. Annual Report. 1999. Border Technikon: East London.

Border Technikon. Annual Report. 2000. Border Technikon: East London.

Border Technikon. Research Report. 2001 - 2002. Border Technikon: East London.

Border Technikon. Research Department. Annual Report to Senate. 2003.

Border Technikon Research Strategic Plan 2001 - 2005. Border Technikon: East London.

Cape Technikon. Decade of Research. 1988 - 1998. Cape Technikon: Cape Town.

Cape Technikon. Research Report. 1999 - 2002. Cape Technikon: Cape Town.

Cape Technikon. Research Report. 2003. Cape Technikon: Cape Town.

Centre for Science Development. CSD 2/96. Technikon Regulations. Grants and scholarships for study and research in the Human Sciences at Technikons. CSD Technikon Research Development Programme.

Chetty, R. 2003. Research and development in technikons: lacunae and challenges. *South African Journal of Higher Education*. 17 (1):9-15. South African Universities Vice Chancellors Association: University of South Africa.

Cloete, N., Nkhulu, M. 1992. National Education Policy Investigation. Post-Secondary Education. A project of the National Education Co-ordinating Committee. Oxford University Press / NECC: Cape Town.

Committee of Technikon Principals. 1989. A Research Philosophy for Technikon Education. Committee of Technikon Principals: Pretoria.

Committee of Technikon Principals. 1991. A minute on Career Education and Technology: Policy Statement. Committee of Technikon Principals: Pretoria.

Committee of Technikon Principals. 1994. A Framework for the introduction of degrees at Technikons. Committee of Technikon Principals: Pretoria.

Committee of Technikon Principals. 1996. A Philosophy for the education of School and Adult Educators at Technikons. Committee of Technikon Principals: Pretoria.

Committee of Technikon Principals. 1998. A Research Philosophy for Technikons in South Africa. Committee of Technikon Principals: Pretoria.

Committee of Technikon Principals. 1999. Current research projects at technikons in the Republic of South Africa. Committee of Technikon Principals: Pretoria

Committee of Technikon Principals. 1999. Completed and discontinued projects at technikons in the Republic of South Africa. Committee of Technikon Principals: Pretoria

Committee of Technikon Principals. 1999. Guidelines for the implementation of research and development programmes at technikons. Committee of Technikon Principals: Pretoria. 3-4 June 1999.

Committee of Technikon Principals. 2002a. The reconfiguration of the higher education sector and its implications for technikons. Submission to the Minister of Education. August 2002.

Committee of Technikon Principals. 2002b. Views of the Committee of Technikon Principals on the designation of the proposed comprehensive institutions. 18 November 2002.

Committee of Technikon Principals. 2003. Change in the name for the technikons in South Africa. <http://www.technikons.co.za>. [on-line] [accessed: 13 June 2003].

Committee of Technikon Principals. 2004. Research and Development Report. Executive Summary.

Cooper, D. 1992. *Technikons in South Africa - some basic coordinates*. Draft paper presented to the NEPI Conference on Human Resources Policy for a New South Africa. 7 - 10 May 1992: Durban.

Cooper, D. 1993. *Science and Technology – a “hidden crisis” of post-secondary education in South Africa? Shape and Size of S & T in the Technikons*. Paper read at Africa Seminar. Gallery Extension Oppenheimer Institute Building.

Cooper, D. & Subotzky, G. 2001. *The Skewed Revolution. Trends in South African Higher Education: 1988 - 1998*. Education Policy Unit. University of the Western Cape: Bellville.

Council on Higher Education (CHE). 2000. *Towards a New Higher Education Landscape. Meeting the Equity, Quality and Social development imperatives of South Africa in the 21<sup>st</sup> Century*. Council on Higher Education: Pretoria.

Council on Higher Education. (CHE). 2003. *Improving Teaching and Learning Resources Draft for 2003 workshops*.

Daniël Pienaar Technical High School. 107<sup>th</sup> Anniversary Reunion Celebrations. 26-27 April 2002.

Department of National Education. 1988. *A Philosophy for Technikon Education*. NATED 02-118 (88/07). Department of National Education: Pretoria.

Department of National Education. 1989. *National Education Policy. An investigation of government financing of Technikons*. NATED 02-131 (89/01). Department of National Education: Pretoria.

Department of National Education. 1992. *National Education Policy. Revision of the subsidy formula for Technikons: Technical Report*. NATED 02-326 (92/11). Department of National Education: Pretoria.

Department of National Education. 1992. *Education Renewal Strategy. Management solutions for education in South Africa*. Department of National Education: Pretoria.

Department of National Education. 1993. *National Education Policy. Education challenges in a changing South Africa*. NATED. 02-327 (93/12). Department of National Education: Pretoria.

Department of Education. 1995. *National Education Policy. Requirements for National Instructional Programmes at Technikons*. Report 150 (95/01) Department of Education: Pretoria.

Department of Education. 1997. *Information survey Manual (Research output of Technikons)* NATED 024 (97/10). Department of Education: Pretoria.

Department of Education. 1997. *Draft White Paper on Higher Education. White Paper 3. General Notice 712 of 1997*. Ministry of Education: Pretoria.

Department of Education. 1997. *National Education Policy. Information Survey Manual. Report 024 (97/10)*. Department of Education: Pretoria.

Department of Education. 2000. *National Plan for Higher Education*. Department of Education: Pretoria. February 2001.

Department of Education. 2002. *Transformation and Restructuring: A new institutional landscape for higher education*. Government Notice. Gazette No. 23549. No. 855. 21 June 2002.

Department of Education. 2003. Higher Education Restructuring and Transformation. Guidelines for mergers and incorporations. Ministry of Education. April 2003.

Department of Education. 2003. New Names For Merging Institutions Of Higher Education In South Africa. Press Statement by the Ministry of Education. 21 October 2003.

De Villiers, F.J. 1949. Report of the Commission on Technical and Vocational Education. Union of South Africa Government Printer. U.G. 65/1948.

Du Plessis, H.A. 1997. Vaal Triangle Technikon. Research Report.

Du Plessis, H.A. 1998. Vaal Triangle Technikon. Research Report.

Du Pré, R. 2002. Press statement of Committee of Technikon Principals. 9 December 2002.

Du Preez, A. 1992. Annual Report of the Committee of Technikon Principals. 1991. Committee of Technikon Principals. Place of publication not indicated.

Du Toit, P.H. & Van der Wal, R.W.E. 1994. *The development of a research culture at Technikon Northern Transvaal*. Institutional Research: The state of the Art in Southern Africa. Selected proceedings of the inaugural forum of the South African Association for Institutional Research. 17-18 November : 87-103.

Dyason. K. Pretoria Technikon. Research Output. 1999 - 2002.

Dyason. K. Pretoria Technikon. Masters and Doctoral graduations 2000 - 2002.

Eastern Cape Technikon. Annual Report. 1998. Eastern Cape Technikon. East London.

Eastern Cape Technikon. Research Report. 1998. Eastern Cape Technikon. East London.

Eastern Cape Technikon. Annual Report. 1999. Eastern Cape Technikon. East London.

Eastern Cape Technikon. Research Report. 1999. Eastern Cape Technikon. East London.

Eastern Cape Technikon. Annual Report. 2000. Eastern Cape Technikon. East London.

Eastern Cape Technikon. Annual Report. Department of Staff and Academic Development. 2000. Eastern Cape Technikon. East London.

Eastern Cape Technikon. Annual Report. Department of Staff and Academic Development. 2001. Eastern Cape Technikon. East London.

Eastern Cape Technikon. Annual Report. 2002. Eastern Cape Technikon. East London.

Eckert, J.B. 1994. Challenges in the 1990s: An environmental scan. *South African Journal of Higher Education*. 8(2):26-29. South African Universities Vice Chancellors Association: University of South Africa.

Grobbelaar, J.W. 1993. Diversity in tertiary education: What, Where and How much. *South African Journal of Higher Education*. 7 (1): 59-69. South African Universities Vice Chancellors Association: University of South Africa: Pretoria.

Haag, D.E. *Trials and Tribulations of technikon research*. Paper presented at CSD/FRD International Conference. Technikon Research Development - The RDP Challenge. Technikon Pretoria. 26-27 June 1995:121 - 125.

Hay, H.R., Fourie, M., & Hay, J.F. 2001. Are institutional combinations, mergers or amalgamation the answer? An investigation into staff perceptions. *South African Journal of Higher Education*. 15 (1): 100-103. South African Universities Vice Chancellors Association: University of South Africa: Pretoria.

Higher Education Act No. 30 of 1923. Gazette Extraordinary No. 1330 of 30 June 1923. National Library: Cape Town.

Jacobs, D.J. 1996. *Sertec and the way forward*. Paper presented at the Quality Assurance Conference of the University of the Orange Free State, Bloemfontein. 19-20 March 1996.

Jacobs, D.J. 1997. Sertec: Guardian of Quality in Technikon and Agricultural College Education - An historical overview 1983 - 1997. Sertec: Alkantrant.

Jacobs, D.J. 2000. A future quality assurance scenario for South African Higher Education. *South African Journal of Higher Education*. 14 (2):69-74. South African Universities Vice Chancellors Association: University of South Africa: Pretoria.

Khoapa, B. 2000. Annual Report of the Committee of Technikon Principals. 1999. Committee of Technikon Principals: Durban.

Knoll, L.B. 1982. Annual Report of the Association of Technikons. 1981. Association of Technikons: Vanderbijlpark.

Kok, P. 1998. Technikon Northern Gauteng. Directorate Research. Annual Report.

Kok, P. 1999. Technikon Northern Gauteng. Directorate Research. Annual Report.

Kok, P. 2000. Technikon Northern Gauteng. Directorate Research. Annual Report.

Kok, P. 2001. *Technikon Northern Gauteng: Initiatives to start with Research*. Benchmarking Research Performance at South African Higher Education Institutions: 269 - 272. Centre for Interdisciplinary Studies University of Stellenbosch: Stellenbosch.

Kritzinger, A. 2000. Technikon Southern African. Annual Research Report.

Lategan, L.O.K. 2003. in Research Made Easy Part 1 - A general overview of the research process and context. Lategan, L.O.K., Vermeulen, W., & Truscott, M. Tekskor BK: Bloemfontein.

Lenyai, G.S.K. 1997. Annual Report of the Committee of Technikon Principals. 1996. Committee of Technikon Principals: Mpekwini Sun.

Lenyai, G.S.K. 1998. Annual Report of the Committee of Technikon Principals. 1997. Committee of Technikon Principals: Sanlameer.

- Loots, H. A. 1983. Annual Report of the Association of Technikons. 1982. Association of Technikon: Johannesburg.
- Lurie, J. 2000. Technikon Witwatersrand - A History 1925 - 2000. Fishwicks - The Printers: Johannesburg.
- Mabandla, L. 1993. *The ERS: Implications for governance in the future*. South African Journal of Higher Education. 8 (1): 11-14. South African Universities Vice Chancellors Association: University of South Africa.
- Mabuza, B.R. 1999. Vaal Triangle Technikon. Research Report.
- Mabuza, B.R. 2000. Vaal Triangle Technikon. Research Report.
- Malan, F.S. 1911. Conference on Technical, Industrial and Commercial Education held in the Provincial Council Chamber, Pretoria. 9-11 November 1911.
- Marsh, C. Border Technikon. Activity area funding. 1997 – 2000. Electronic mail Marsh, C. 25 August 2004.
- Martin, B. R. 2005. *The changing social contract for science and the evolution of the university*. in Geuna, A., Saltor, A.J. & Steinmueller, W.E. Science and Innovation. Rethinking the Rationales for Funding and Governance. Edward Elgar. United Kingdom.
- Moeti, M. 1995. *The future of technikons and their role in research development*. Paper presented at CSD/FRC International Conference. Technikon Research Development - The RDP Challenge. Technikon Pretoria. 26-27 June 1995:249 - 253.
- Mokadi, A.T. 2001. Vaal Triangle Technikon. Research Report.
- Morgan, N. 2000. Opening Address at Panel Discussion "Research Challenges at Technikon SA" 18 May 2000.
- National Research Foundation. Register of Grants. 1999/2000.
- National Research Foundation. Register of Grants. 2000.
- National Research Foundation. THRIP Projects Register. 1998-2002
- National Research Foundation Social Sciences and Humanities. 2000(a). Technikon Research Development Programme. NRF:SSH 2/2000 Regulations.
- National Research Foundation. 2000(b). Discussion Document. Regional Workshops on proposed NRF Focus Areas.
- National Research Foundation. 2000(c). Guide to NRF Research support for 2001. July 2000.
- National Research Foundation. 2000(d). Evaluation of the programmes and activities of the former CSD and FRD. The report of the Review Panel aimed at stimulating and informing the discussions regarding the way forward for the NRF. April 2000.
- National Research Foundation. 2001(a). NRF Technikon Programme. Manual for grant holders (in approved activity areas). July 2000.

- National Research Foundation. 2001(b). NRF Technikon Programme. Manual 2001. January 2001.
- National Research Foundation. 2001(c). NRF Grants Register. 2001.
- National Research Foundation. 2002(a). Technikon Research Development Programme. Programme Framework (2002 - 2007).
- National Research Foundation. 2002(b). Guide to Research Support 2002.
- National Research Foundation. 2002(c). Technikon Research Development Programme. Manual for 2002.
- National Research Foundation. 2002(d). NRF Grants Register. 2002.
- Norris, B.D. 1994. Managing diversity within South African Technikons: A strategic management approach. Thesis submitted in fulfillment of the requirements for the degree *Doctor Educationis*. Faculty of Education at the University of Port Elizabeth.
- Ogude, N. 2000. Focus on Research. Occasional Publication Series. Technikon SA. Foreword to publication. 21 October 2000.
- Ogude, N. 2001. Focus on Research. Occasional Publication Series. Technikon SA. Research Management. Foreword to publication. Issue 1. March 2001.
- Ogude, N.A & Motha, N.A. 2001. A proposal for and incentive tool for development of research capacity at technikons. *South African Journal of Higher Education*. 15 (3):58-65. South African Universities Vice Chancellors Association: University of South Africa: Pretoria.
- Peninsula Technikon. Annual Report. 1996. Peninsula Technikon: Belville.
- Peninsula Technikon. Growing Research, Growing Scholarship. No date
- Peninsula Technikon. List of publications for 2001 and outputs submitted to the Department of Education, 2002. Electronic mail: 28 July 2004. Fransman, H.
- Petersen, F.W. and Coetzee, J.W. *Technikon Research - a challenge within a changing South African Society*. Paper presented at the CSD/FRD International Conference 'Technikon Research Development - The RDP Challenge. Technikon Pretoria. 26-27 June 1995:337-340.
- Phillips, W. E. 1980. Annual Report of the Association of Technikons. 1979. Association of Technikons: Place of publication not indicated.
- Pietersen, H.J. 1995. *Technikon Research at the frontline: some problems and challenges*. Paper presented at the CSD/FRD International Conference 'Technikon Research Development - The RDP Challenge. Technikon Pretoria. 26-27 June 1995:87-96.
- Pittendrigh, A. 1988. Technikons in South Africa. The Building Industries Federation South Africa: Halfway House.
- Plug, C. 1993. Mechanics' institutes in nineteenth-century South Africa. *South African Journal of Higher Education*. 7 (3):97-101. University of South Africa: Pretoria.



- Port Elizabeth Technikon. Annual Report. 1999. Port Elizabeth Technikon: Port Elizabeth.
- Port Elizabeth Technikon. Research Report. 1999. Port Elizabeth Technikon: Port Elizabeth.
- Port Elizabeth Technikon. Annual Report. 2000. Port Elizabeth Technikon: Port Elizabeth.
- Port Elizabeth Technikon. Annual Review. 2001. Port Elizabeth Technikon: Port Elizabeth.
- Port Elizabeth Technikon. Annual Review. 2002. Port Elizabeth Technikon: Port Elizabeth.
- Port Elizabeth Technikon. Annual Research Review. 2003. Port Elizabeth Technikon: Port Elizabeth.
- Pretoria Technikon. Research and Development at Pretoria Technikon. 1996 - 2003. Pretoria Technikon: Pretoria.
- Pretoria Technikon. Research and Development Report. 2002. Pretoria Technikon: Pretoria.
- Pretorius, J. 1996. Vaal Triangle Technikon. Research Report. Vaal Triangle Technikon: Vanderbijlpark.
- Pretorius, J. 1997. Vaal Triangle Technikon. Research Report. Vaal Triangle Technikon: Vanderbijlpark.
- Ramchander, P. 2000. *Research challenges at Technikon SA: The hidden potential*. Paper read at panel discussion. Research challenges at Technikon SA. 18 May 2000.
- Rees, W. 1957. The Natal Technical College 1907 - 1957. University of Natal Press: Durban.
- Republic of South Africa. 1997. Higher Education Act No. 101 of 1997. 19 December 1997. Issue no. 35. Statutes of the Republic of South Africa.
- Reyneke, W.F & de Boer, A. 1994. Degree courses for Technikons - Challenges for academic staff. *TNT TEACHING NEWS TODAY* - Newsletter on teaching and learning. (4) February:1-3. Department: Teaching and Learning. Technikon Northern Transvaal. Pretoria.
- Roos, K. 2004a. Committee of Technikon Principals. Subsidised Research Outputs for universities and technikons. 1998 - 2002.
- Roos, K. 2004b. Committee of Technikon Principals. Technikon Profiles. 1999 - 2002.
- SERTEC. 2000. Quality Assurance in Higher Education. A guide for evaluation committees. SERTEC 1-06(06/00). SERTEC: Pretoria.
- Shippey, T.C. 1986. Annual Report of the Committee of Technikon Principals. 1985. Committee of Technikon Principals: Cape Town.



- Shippey, T.C. 1987. Annual Report of the Committee of Technikon Principals. 1986. Committee of Technikon Principals: Cape Town.
- Snape, A.E. 1912. Report on Technical Instruction in the Union of South Africa. U.G. No. 2-12. The Government Printing and Stationery Office. Pretoria
- Snyman, H.C. 1995. Annual Report of the Committee of Technikon Principals. 1994. Committee of Technikon Principals: Port Elizabeth.
- Snyman, H.C. 1999. Annual Research Report. Port Elizabeth Technikon. 1998. Port Elizabeth Technikon: Port Elizabeth.
- Snyman, H.C. 2000. Port Elizabeth Technikon. Annual Report. Port Elizabeth Technikon: Port Elizabeth.
- Snyman, H.C. 2003(a). CTP Perspectives on the transformation of Higher Education. (Input by Prof Hennie Snyman: Chairperson of the CTP). 6 May 2003. Union Buildings. Pretoria.
- Snyman, H.C. 2003(b). Committee of Technikon Principals. Press Release 6 June 2003. Committee of Technikon Principals: Pretoria.
- Soer, J.W.A. 1998. *Implications of the introduction of degree programmes in the faculty of education at the Technikon Northern Gauteng*. Tutor - Bulletin for Academic Staff, Department Teaching and Learning Development. 6 (1):2-16.
- Sonn, F.A. 1992. *Technikons: The Way Forward*. Address given at the USUSA Conference. Transforming South African Universities. University of Durban-Westville. 1 July 1992.
- Sonn, F.A. 1993. Annual Report of the Committee of Technikon Principals. 1992. Committee of Technikon Principals: Belville.
- Sonn, F.A. 1994. Annual Report of the Committee of Technikon Principals. 1993. Committee of Technikon Principals: Bellville.
- South Africa Act, 1909. National Library: Cape Town.
- Stewart, G. 1995. *Building a research culture at the M L Sultan Technikon*. Paper presented at the CSD/FRD International Conference 'Technikon Research Development - The RDP Challenge. Technikon Pretoria. 26-27 June 1995:109-119.
- Swanepoel, P.A. 1996. Technikon Vaal Triangle. Research Report. Vaal Triangle Technikon: Vanderbijlpark.
- Steyl, I. 1986. Annual Report of the Committee of Technikon Principals. 1985. Committee of Technikon Principals: Vanderbijlpark.
- Steyl, I. 1989. Annual Report of the Committee of Technikon Principals. 1988. Committee of Technikon Principals: Vanderbijlpark.
- Swanepoel, P.A. 1996. Vaal Triangle Technikon. Research Report. Vaal Triangle Technikon: Vanderbijlpark.

Taylor, D.W. 2001. *The development of a Technikon SA Institutional Research Plan*. Paper developed from presentation at institutional seminar. Focus on Research: A Framework for Implementing an Institutional Research Plan. Technikon Southern Africa. November 2000.

Technikons Act, No. 125 of 1993. National Library: Cape Town.

Technikons Amendment Act, No. 27 of 1995. National Library: Cape Town.

Technikon Northern Gauteng. Directorate Research. Annual Report. 1998. Technikon Northern Gauteng: Soshanguwe.

Technikon Northern Gauteng. Directorate Research. Annual Report. 1999. Technikon Northern Gauteng: Soshanguwe.

Technikon Northern Gauteng. Directorate Research. Annual Report. 2000. Technikon Northern Gauteng: Soshanguwe.

Technikon Northern Gauteng. Directorate Research. Annual Report. 2001. Technikon Northern Gauteng: Soshanguwe.

Technikon Northern Gauteng. Directorate Research. Annual Report. 2002. Technikon Northern Gauteng: Soshanguwe.

Technikon Southern Africa. Annual Report. 1999. Technikon Southern Africa: Florida.

Technikon Southern Africa. Annual Research Report. 2000. Technikon Southern Africa: Florida.

Technikon Southern Africa. Research Report. 2001/2002. Technikon Southern Africa: Florida.

Technikon Witwatersrand. Research Report. 1998. Technikon Witwatersrand: Johannesburg.

Technikon Witwatersrand. Research Report. 1999. Technikon Witwatersrand: Johannesburg.

Technikon Witwatersrand. Research Report. 2000. Technikon Witwatersrand: Johannesburg.

Technikon Witwatersrand. Research Development Unit. Annual Report. 2001. Technikon Witwatersrand: Johannesburg.

Technikon Witwatersrand. Research Development Unit. Annual Report. 2002. Technikon Witwatersrand: Johannesburg.

Uken, E. 1995. *Creating a meaningful technikon research culture*. Paper presented at the CSD/FRD International Conference 'Technikon Research Development - The RDP Challenge. Technikon Pretoria. 26-27 June 1995:147-150.

Uken, E. 1999. Research Development Department. Decade of Research 1988 - 1998. Cape Technikon. Cape Town.

Uken, E. 2001. *Bedrocking Research Cape Technikon, Case Study*. Benchmarking Research Performance at South African Higher Education Institutions: 239 - 248. Centre for Interdisciplinary Studies. University of Stellenbosch, Stellenbosch.

Vaal Triangle Technikon. Research Report. 1998. Vaal Triangle Technikon: Vanderbijlpark.

Vaal Triangle Technikon. Research Report. 1999. Vaal Triangle Technikon: Vanderbijlpark.

Vaal Triangle Technikon. Research Report. 2000. Vaal Triangle Technikon: Vanderbijlpark.

Vaal Triangle Technikon. Research Report. 2001. Vaal Triangle Technikon: Vanderbijlpark.

Vaal Triangle Technikon. Research Report. 2002. Vaal Triangle Technikon: Vanderbijlpark.

Van der Horst, *et al.* 1928. Report of the University Commission. The Government Printing and Stationery office: Pretoria.

Van der Spuy, D. C., Du Toit, W, van Rooyen, I. *et al.* 1975. Eerste uitgawe. Die Amptelike Jaarboek van die Republiek van Suid-Afrika. Suid-Afrikaanse Departement van Inligting: Pretoria.

Van Rensburg, D.J.J. 1985. Annual Report of the Committee of Technikon Principals. 1984. Committee of Technikon Principals: Pretoria.

Van Rensburg, D.J.J. 1987. *Navorsing en die moderne Technikon*. Openingstoespraak gelewer tydens Navorsingseminaar. 17 Junie 1987. Technikon Pretoria.

Van Rensburg, D.J.J. 1995. *Technikon Research Development - The future role of Technikons in South Africa*. Paper presented at the CSD/FRD International Conference 'Technikon Research Development - The RDP Challenge. Technikon Pretoria. 26-27 June 1995:7-26.

Van Rensburg, D.J.J. 1996. Annual Report of the Committee of Technikon Principals. 1995. Committee of Technikon Principals: Sabi Sabi Game Reserve.

Van Rensburg, D.J.J. & Moore, D. *et al.* 2001. Establishment of Universities of Technology in South Africa. Report of the CTP Task Team on "Universities of Technology", February 2001.

Van Rensburg, D, Dürheim, H, van Eldik, P, Youngleson, J. 2003. Technikons' Strategy for Innovation and Technology Transfer. Document developed for the Committee of Technikon Principals. 22 April 2003.

Van Rensburg, C.A.J. & Greyling, J.S. 1985. Technikon Research in Perspective. Research Bulletin. *Journal for the South African Plan for Research in the Human Sciences*. 15(3):1-4.

Van Wyk, C. 1999. Eastern Cape Technikon. Research Report. Eastern Cape Technikon: Butterworth.

Vocational Education Act, No. 70 of 1955. National Library: Cape Town.

Von Gruenewaldt, G. 1995. *Quality Assurance and Research Development*. Paper presented at the CSD/FRD International Conference 'Technikon Research Development - The RDP Challenge. Technikon Pretoria. 26-27 June 1995:115-119.

Wiid, D.H. 1988. *Die toekomsrol van teknikons*. Referaat gelewer tydens FAK Simposium. Technikon Witwatersrand. 21 Oktober 1988.

Wiid, D.H. 1991. Annual Report of Committee of Technikon Principals. 1990. Committee of Technikon Principals: Johannesburg.

Welsh, D. in Wilson, M. & Thompson, L. 1975. The Oxford History of South Africa. II. South Africa 1870 - 1966. University Press: Oxford.

Winberg, C. 2005. Continuities and discontinuities in the journey from technikon to university of technology. *South African Journal of Higher Education*. 19 (2):89-200. University of South Africa: Pretoria.

Wolffe, H. 1981. Annual Report of the Association of Technikons. 1980. Association of Technikon: Place of publication not indicated.

## INTERNET SOURCES

<http://www.anc.org.za/books/ccsa/01.html>. [on-line] [accessed: 02/04/2001].

<http://mars.acnet.wnec.edu/grempe/courses/wc2/lectures/industrialrev.html>. [on-line] [accessed: 21/01/2002].

<http://www.mantech.ac.za>. [on-line] [accessed: 04/08/2004].

<http://www.technikons.co.za/CTP.html>. [on-line] [accessed: 30/1/2000].

(<http://sahistory.org.za/pages/classroom/projects/grade12/lessons/unit3-bantu-auth-act-1951.htm>) [on-line] [accessed: 01/03/2004].

<http://www.pwv.gov.za> [on-line] [accessed: 30/10/2003].

[http://www.cellular.co.za/news\\_1999](http://www.cellular.co.za/news_1999) [on-line] [accessed: 12/02/2005].

<http://www.info.gov.za/speeches/2004> [on-line] [accessed: 12/02/2005].

[http://www.vut.ac.za/technology\\_station.htm](http://www.vut.ac.za/technology_station.htm). [on-line] [accessed: 12/02/2005].

<http://www.tellabs.com>. [on-line] [accessed: 12/02/2005].

Macozoma, S. 2002. National Working Group Recommendations.

[http://education.pwv.gov.za/what'snew/what's\\_new.htm](http://education.pwv.gov.za/what'snew/what's_new.htm). [on-line] [accessed: 12/02/2002].

Tessmar, U. Technology Stations Programme. Concept and status. 28 May 2002. <http://www.technikons.co.za> [on-line] [accessed: 14/3/2003].